

*news, knowledge, advice*

# SCIENCE DIGEST

AUGUST 1967 • 50 CENTS 100

## VISUAL PERCEPTION

(Which way is up?)

Mystery of the  
Inca's lost city

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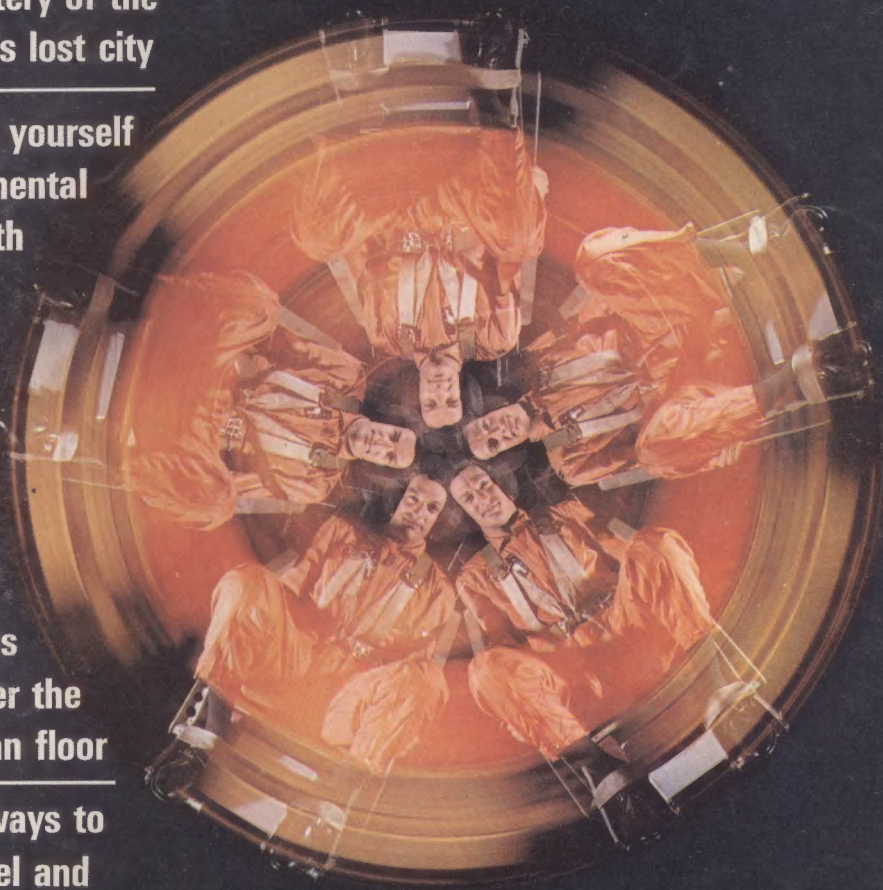
Cities  
under the  
ocean floor

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10 ways to  
travel and  
stay well

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How science is  
exposing phony art



**SPECIAL:**

**PLASTICS**—the material that  
will soon make nearly everything



## Further adventures of Snowflake

THE orphan albino gorilla found in an African banana patch has a new mother. When the two-year-old ape arrived at the Barcelona zoo, Maria Garcia, wife of the zoo's vet, Dr. Román Luera Carbó, took him for her own. "He is a very difficult baby what with his nervous disposition and tendency to take cold," says Señora Luera. But she and her husband were afraid he'd die if caged. They kept him and named him Copito de Nieve (Little Snowflake).

The real mother of the blue-eyed ape (see the July cover of *Science Digest*) was shot while ripping apart banana plants in Spanish Guinea. Snowflake was found clinging to the body. He was taken to the zoo's acclimatization center on the coast where naturalist Jorge Sabater Pí tamed him. Sabater's wife gave him a bath, and his eight-year-old son wrestled with the ape. At Barcelona, the only known albino gorilla greeted Dr. Luera with a hug. After that, how could he put Snowflake in a cage?

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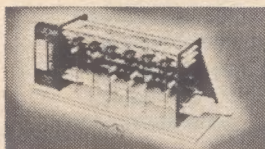
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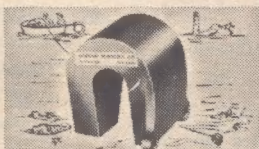
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**T**HE recent rash of spurious art "masterpieces" being sold to collectors and museums, sent our roving editor Bruce Frisch off on an investigation to find out how the experts detect the fakes. What he unearthed appears in the interesting report he wrote, on page 6.

The fact that nearly flawless copies of old masters are everywhere is no news, but there's one case of duplicate masterpiece that

## THIS MONTH

has never been explained to my satisfaction. In 1964-'65 many of us saw Michelangelo's superb Pieta at the New York World's Fair. Yet, in the Spring of '65, my own family and I visited St. Peter's in Rome. There, in a vaulted apse was—guess what? The Pieta, by Michelangelo! Even the sign said so. It said nothing about it being a copy—nor did it mention anything about the Pieta being at the New York World's Fair simultaneously! That evening, dining with a priest we knew, he asked us, with a sly grin: "How did you like the copy of the Pieta at the Fair?"

Was the one in dim blue light at the Fair a duplicate of the real one? Or was the one on display in St. Peter's a pinch-hitter? Both were billed as the genuine sculpture. Obviously, one was a copy. Michelangelo only carved one!

Which one was the phony?—RFD

*news, knowledge, advice*

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# DIGEST

AUGUST • 1967

Vol. 62, No. 2

Before space flights, experts feared astronauts' perception would be violently disrupted. To test the spacemen, they were put on spin tables and whirled to see how disoriented they'd become. Would they "greyout"? Lose sense of direction? Actually, the experts got a big surprise. To find out what they learned, and what other labs have found, see page 14.

Pictorial Parade



## CONTENTS

### SCIENCE NEWS

Bulletins at Press Time	4
New for People	26
Science Month	28
Tips and Trends	32
New for Industry	54

### ARCHAEOLOGY

Lost City of the Incas (A Science Mystery)	68
---	----

### ASTRONOMY

Lunar Spectacular	20
-------------------	----

### CHEMISTRY

SPECIAL: Plastics: Material that will soon make everything	45
--	----

### GEOLOGY

Cities Under the Ocean Floor	36
------------------------------	----

### INVENTIONS

Baggage Bike	78
--------------	----

### MEDICINE

Skin Reflects Your Health	21
How to Stay Healthy While Traveling	73
We're Smarter About Health	80

### PHYSICS

How Hard Does a Baseball Fall?	12
--------------------------------	----

### PHYSIOLOGY

Solving the Mystery of Sleep	43
------------------------------	----

### PSYCHIATRY

Test Yourself on Mental Health	56
--------------------------------	----

### PSYCHOLOGY

Visual Perception: Which Way is Up?	14
--	----

### TECHNOLOGY

How Science Uncovers Fake Art	6
----------------------------------	---

### ZOOLOGY

Manatees—Living Lawn Mowers	33
Should We Make Pets of Wild Animals?	61

## DEPARTMENTS

This Month	2
Colleges in Action	65
Isaac Asimov Explains	85

Books	91
Quiz	88
Letters	95

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*Bulletins at press time*

DDT IN YOUR FOOD. A Food and Drug Administration report indicates that traces of pesticides can be found in about half the nation's food supply. Says the report, "Current levels of pesticide residues in that nation's food supply are not approaching the danger level. (But) the frequency with which residues are found suggests that further increases are undesirable."

HEPATITIS AND BIRTH DEFECTS. Dr. Barbara Mella a Harvard Medical School physician has discovered that the virus-like agent believed to cause acute infectious hepatitis, can also damage the chromosomes. Such damage could affect the development of an unborn child and result in serious birth defects like mongolism.

'AGING' MILKY WAY. Data received from rocket-astronomy suggests that our galaxy, the Milky Way, is a comparatively old galaxy, rather than a young one as had been previously believed.

AUSTRALIA IN ORBIT. If present schedules are met Australia will be the fourth nation to put a satellite into orbit. Target date for the Aussie weather satellite is next February or March. Launch vehicle will be a U.S. Redstone.

ACCELERATOR SLOWDOWN. The giant atomic accelerator scheduled for the little Illinois town of Weston may be put off another year. Reason: Congress is trying to hold down nonmilitary spending.

FLYING AMBULANCES. Because of quick evacuation by helicopter more than 99 percent of the casualties in Vietnam survive. The flying ambulance technique may soon be put to wide use in rural areas in the U.S. Methodist Hospital in Memphis has received Federal Aviation Agency approval for a heliport on the hospital's roof. Says a hospital spokesman, "It's only a matter of time when civilian hospitals will avail themselves of the services of medical helicopters."



## Do Unseen Powers Direct Our Lives?

ARE the tales of strange human powers false? Can the mysterious feats performed by the mystics of the Orient be explained away as only illusions? Is there an intangible bond with the universe beyond which draws mankind on? Does a mighty Cosmic intelligence from the reaches of space ebb and flow through the deep recesses of the mind, forming a river of wisdom which can carry men and women to the heights of personal achievement?

### Have You Had These Experiences?

... that unmistakable feeling that you have taken the wrong course of action, that you have violated some inner, unexpressed, better judgement? The sudden realization that the silent whisperings of self are cautioning you to keep your own counsel—not to speak words on the tip of your tongue in the presence of another. That something which pushes you forward when you hesitate, or restrains you when you are apt to make a wrong move.

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Collection Walker Art Center, Minneapolis

Stripped of his fancy coat and plumed hat during cleaning, Henry VIII by Holbein turned out to be a sober Dutch burgher by Gerbrand Ban, a less valued painter.

## How science uncovers art fakes

*From ancient times until the present day art forgery has been a thriving, and often profitable business. But now sophisticated methods of scientific detection are making life more difficult for the crafty fakers.*

by Bruce Frisch

On a February afternoon this year five prominent art dealers strode up to the house of wealthy oilman Algur Meadows in Dallas. As the door opened, a huge Vlam-inck painting stared out at them. "Fake," they ruled. Eyes shifted to a Picasso opposite. "Another fake."

For the next two hours the delegation wandered through more than 15 rooms viewing a collection valued at \$1,362,750 and numbering 58 works. Forty-four were readily recognizable as forgeries, confirming the judgment of Ralph Colin, vice president and general counsel for the Art Dealers Association of America that, "Most—not all—but most fake

paintings are patently rotten . . . In most cases, particularly with respect to painting of the last 100 years, an art historian or someone with a 'eye' should be able to 'read' the painting at sight and identify it as authentic or not."

But a small percentage of forgeries are more expertly done. These require a scientific going over. The intuitive method "is a direct invitation to the forger to try his luck or skill," warns George Savage, author of "Forgeries, Fakes and Reproductions."

To style, science adds three more tests: for signs of age, correct materials and what might be called inner truth. Most art objects develop a patina with age. To hasten the apparent aging of a fake Roman sculpture he had made, called "Sleeping Cupid," Michelangelo buried it. Eventually Cupid was sold to Cardinal Riario. When the Cardinal discovered the deception, he forced the refund of his money, but kept the statue.

In paintings, the most obvious sign of age is a fine system of cracks, called the craquelure. "There exist many genuine painting which show no cracks; they are never absent in forgeries," says Dr. Max Friedlander. Han Van Meegeren, the forger of Vermeer, took particular pains with his craquelure.

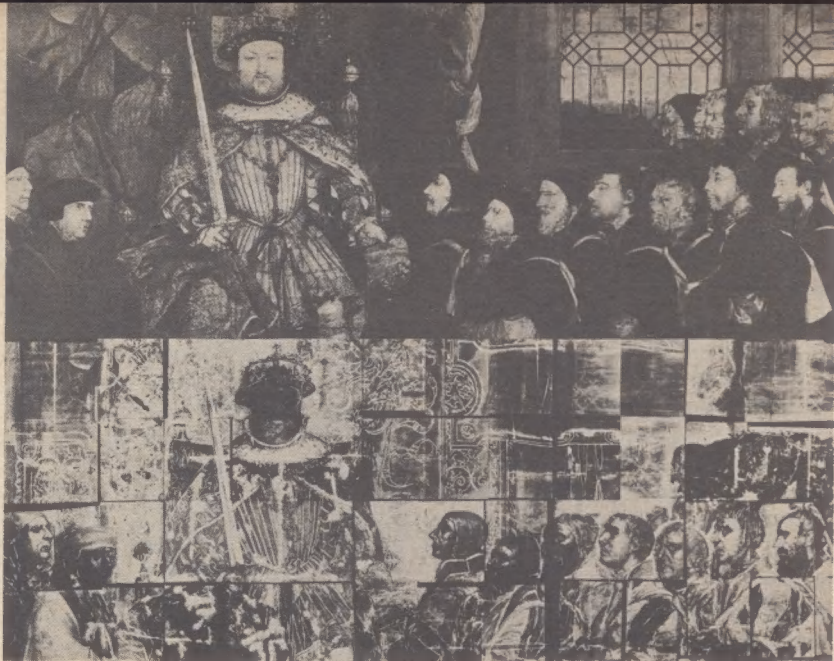
He started out by buying a cheap, but old painting from which he removed almost all the paint to try to escape X ray detection. He kept just enough of the old paint to preserve the original craquelure.

Over this he painted his forgery. Instead of mixing pigments in oil, he used a synthetic resin medium. When baked for a few hours at a little over 200 degrees, the synthetic resin cracked, following much of the underlying authentic pattern. Van Meegeren followed up by wrapping the canvas around a roller in several different directions to produce more cracks in the hardened resin. He next spread ink over the painting, then wiped it off, leaving ink in the cracks to simulate the dirt of centuries. More often, forgers engrave cracks in the surface or paint them on the painting.

### Evidence of the cracks

After all the pains taken, Dr. P. B. Coremans, Director of the Central Laboratory of Belgian Museums, caught up Van Meegeren at many points. He found that the "dirt" in the cracks was not dust, flaked varnish and organic matter as it should have been. The crack pattern itself didn't seem to Coremans characteristic of a 17th century Dutch painting. A simple procedure confirmed his doubts. In a section of a Van Meegeren having a lot of white lead underpainting, Coremans made an X ray in which the original, typical pattern clearly showed. Over the X ray he lay an ordinary photo of the same area.

The comparison showed that a second crack pattern had been superimposed on the first, and it was a system of parallel cracks produced by the known trick of rolling. Also,



London Daily Express

This Henry VIII was a real Holbein doctored almost beyond recognition by others. X rays reveal the original buried sketch. Changes are often taken as signs of genuineness—the artist seeking perfection. Willy forgers will fake changes, restorations, touchups and even damage, though always leaving an important face intact.

Modern pigments in an Old Master are a giveaway. This device identifies colors by using a radioisotope to excite X rays in them which are analyzed by computer.

Technical Measurement Corp.



Coremans noted, the islands of paint created by the cracks should have upturned edges; instead they were flat. Nor did the island have cracks extending from the edges to the centers. If faking a small area, some forgers will paint in these secondary cracks.

Simply on the evidence of the cracks, science could have sounded a warning. Unfortunately, the examination was made after Van Meegeren had sold eight fakes for \$2,000,000. But vanity, not money, drove him. At the age of 43 he left his native Holland, because, he said, his genius was underestimated there. By 1937 he had ready a Vermeer "Disciples at Emmaus," "the master-stroke in my plan for vengeance," which he sold to the Boymans Museum in Rotterdam. His later, lesser work went to private collectors under the cover of wartime conditions. One got into the hands of

Hermann Goering and led to a charge of collaboration. Faced with prison, Van Meegeren claimed the painting was his work, not Vermeer's. Coreman's study was to test this claim.

The Van Meegerens sailed through the common quick check for age, the alcohol test. Old paint is hard and impervious to alcohol. New paint is soft and readily colors the cotton swab. Van Meegeren's baked synthetic resin was as resistant as old paint. Old paint, when it has an oil medium, however, is susceptible to alkalis. The resin was just as resistant to alkalis as to alcohol.

Until this year there was no absolute measure of age. The concentration of carbon-14 indicates ages between 1,000 and 50,000 years, more suitable for archeological objects. The new lead-210 method developed at the Mellon Institute in Pittsburgh gives roughly the century of origin in recent times.

In addition to signs of apparent age, materials can be checked to see if they are of the period claimed. Van Meegeren's synthetic resin, patented in 1907, was an obvious giveaway. He was, however, scrupulous with his pigments, even going to the great expense of buying the last known supply of natural ultramarine blue. Unluckily, Coremans found by chemical analysis under the microscope, Van Meegeren had contaminated it with modern cobalt.

With valuable works of art the aim is to make an analysis with the smallest possible sample. One new

method is electron microbeam analysis, developed at the Boston Museum of Fine Arts.

Still another method of checking tiny samples is by neutron activation analysis. The fragment is placed in an atomic reactor where the bombardment of neutrons converts elements into radioactive isotopes which can be identified by the energy levels of the gamma rays they give off. By this method Dr. Edward Sayre at Brookhaven National Laboratory found that crooked Romans were forging other Romans' Arretine ware back in the first century B.C.

Today's Romans are just as active in forging. Not long ago spectroscopic analysis uncovered some of their recent work, the famous Etruscan warriors in New York's Metropolitan Museum of Art. When the Met worked up courage to put them on exhibition in 1933, the whispering began at once. One Italian critic suggested that the glittering fragments in the clay were ground up Peroni beer bottles. A check by the museum showed they were really quartz. Other critics questioned the statues on stylistic grounds, as well they might have. The first warrior was tall and thin, a style with some precedents. The second warrior was tall but stocky. As the story was finally sworn to by a sculptor, he and the rascally Riccardi brothers constructed the warrior in a rented room. This warrior was meant to be just as elongated as the first, but when they reached the waist, the forgers sud-



Pictorial Parade

Which is the real Mona Lisa? An artist's workshop used to turn out replicas and copies of his own work. One El Greco has been discovered in 20 different versions.

denly realized the ceiling was too low, and had to squash the trunk to make it fit. The clinching evidence came in 1959, before the admission. There had just been discovered the long-lost secret of how the Greeks and Etruscans triple-fired their terra cotta to make red and black glazes colored by two forms of iron oxide. Joseph Noble of the Met placed a sample of the warriors' glaze in the electric arc of a spectroscope. Light from the glowing elements indicated that the pigment in the glaze was modern magnesium oxide.

The latest technique requires no sample whatever. It depends on the property of different crystals to scatter X rays at different angles. A computer reads the record of the scattering of X rays aimed at a painting and calculates the composition of the materials.

But signs of age and correct materials aren't all a forger must think of. He must also strive for inner truth to be fully convincing. Few do. They work principally to fool the eye in normal viewing conditions. Beneath the surface or in other kinds of light the fakery may be

obvious. In every period artists have a preferred way of priming their canvases, laying a ground, applying colors and glazes. A cross-section of the painting photographed through the microscope will show up any departures.

Often the shortcomings show right on the surface. For instance, sidelight may reveal the shadowing outlines of an underlying painting. To guard against this, Van Meegeren leveled up the surface of the original on his canvases with a filler.

Materials used to alter painting may match quite well in ordinary light, but even in a black and white photograph or under the yellow monochromatic light of a sodium vapor lamp may look out of place. Under ultraviolet light disparities are usually much more striking. The invisible ultraviolet rays cause some of the substances to fluoresce in visible colors. Like materials should glow alike. Repairs, patches, touch-ups, removed signatures will show.

Infrared, off the other end of the visible spectrum, can pierce the top-most layer of the painting. It is good for penetrating old varnish, particularly the "brown gravy" forgers often use to cloak the more questionable parts of their work. To uncover deeper layers, an X ray is taken. By varying the voltage the technician can vary the penetration. In spite of his cleaning away most of the old paint, several of the original paintings under Van Meegeren's forgeries showed through on X ray examination.

So overpowering are all the sci-

entific tests that can be brought to bear that the modern forgery of a classical painting is rare. In addition, the forger paints the past as seen through the eyes of today. "The life of any forgery is rarely more than a generation," says Savage. Then the figures start to look strangely Victorian, or flapper like or "thirties-ish." How much easier to fake a Picasso where the materials are available at the art supply store and one's outlook is in tune with the times.

It is unfortunate that the services of science are not available to the general public. Museums examine their own acquisitions, but most have strict rules about giving advice to outsiders.

Many collectors are in no hurry to have their purchases examined. "If an object is proved to be a fraud," notes Savage, "the owner

can only resell it as genuine by becoming party to a fraud. Whilst proof is lacking he is under no such disability." If worse comes to worse, says lawyer Alvin Lane, who headed the Committee on Art of the Association of the Benefactors of the City of New York, "unscrupulous owners of art of questionable authenticity who want to salvage their investment, but do not want to risk the embarrassment of possible detection through public sale, resort to tax-deductible gifts to their favorite museums." Included with the fakes is the real thing. The museum takes the package without a murmur. Because they may be afraid of offending patrons, continues Lane, "museums in this country are becoming the custodians of a prodigious number of fakes." The real thing goes on exhibition, the fakes disappear into a storeroom.

Indras on the left is a 14th century statuette from Nepal. On the right is a recent Indra, also from Nepal. Europeans can recognize Oriental copies of European work by the Asian cast of features; all but specialists are blind to the westernization of European forgeries of Asian art, though an Asian sees the imitation quite readily.

Collection anonymous



Collection, Philadelphia Museum of Art





## Problem: How hard does a baseball fall?

by John W. Cox

EACH month on a Wednesday, I used to go to downtown Philadelphia, hunting bargains. On one such Wednesday, in 1939, I left the subway and found thousands of people milling around City Hall. Thousands more peered from windows. A foot policeman maintained an open path under the arches of City Hall and I asked him what all the fuss was about.

"Four Phillies ballplayers are going to catch baseballs thrown from the top of City Hall," he said.

I had played semi-pro baseball and knew the significance of catching a five-and-a-half-ounce hard baseball thrown from a height of over 500 feet. I also knew the penalty of having it hit you. I pushed through the crowds and came within

100 feet of the four ballplayers. They stood fanned out north of City Hall at Broad Street. I estimated that the one to throw the balls was 521 feet up and the ballplayers who were to catch the balls were over 450 feet out. The crowd was standing dangerously close to the ballplayers.

I knew from baseball history that a Chicago National player, Billy Shriver, had caught a baseball tossed from the 500 foot level of the Washington Monument in Washington, D.C.; that Gabby Street of the American League Washington team had some years later in 1908 done the same thing. But catching a baseball practically dropped from the Washington monument is a cinch compared to catching a baseball *thrown* outward in a parabolic arc. In the latter case, a baseball

you miss head high will hit you in the stomach.

The prospect of seeing one of the ballplayers seriously hurt or possibly killed was pretty good. On the back of an envelope I computed that the ball would hit the catcher's mitt with violently destructive force. If he should be hit on the wrist it would be broken; the same if hit on the shoulder, and if hit on the head he would be killed. The least I could do was warn the ballplayers. I beckoned to a mounted sergeant who edged his horse over to me.

I said, "I am a professor of mathematics. I've just computed on this envelope that the ball, when it gets down here, will have a force great enough to maim or kill. The least we can do is warn those ballplayers. Will you go over there and tell them they are trying to catch a cannon-ball? I mentioned the actual weight of the ball on impact.

The sergeant studied me carefully. I was dressed well; he saw I was in earnest. Finally he said, "O.K. I'll tell them what you said."

He sauntered his horse over to the ballplayers and spoke to them, nodding his head toward me. The ballplayer with the largest mitt raised his hand in salutation.

Suddenly a voice on the loud-speaker said, "Stand back; here comes the pitch."

A white dot appeared in the sky and started earthward with a tremendous velocity. The catchers pranced under it. Suddenly the ball hit the cement pavement near "Big Mitt," and bounced six stories.

When it came down Big Mitt caught it; the spectators roared their approval. But the height of the bounce awed most of them; they realized there was a tremendous force here. The carnival spirit vanished.

Nine balls were thrown and Big Mitt almost caught the seventh and eighth. When the ninth ball was thrown Big Mitt pranced a little more than usual; he had his mitt held high; the ball hit squarely in the mitt and almost brought him to his knees, but he held on.

The show was over; the roar of the crowd was tremendous; they had witnessed a remarkable exhibition of skill and coordination. Later, the evening paper told me that "Big Mitt" was Dave Coble, rookie catcher of the Phillies; the other players were Gibbie Black, Del Young and Walter Mellies. Doc Pothro, the manager of the Phillies, and Spud Davis, the regular catcher of the Phillies were high up on the platform and Davis threw the baseballs. The affair was sponsored by the Newspaper Guild of Philadelphia and Camden to advertise an affair to be held at Town Hall.

After reading the paper telling about Coble catching the ball, I checked my figures as to the force of the ball; this time a little more leisurely. I had been right.

*[Editor's note: What was the weight of the ball on impact? The author found it in less than 5 minutes, using simple physics formulas. You'll find the method and the answer on page 19, to check against your own calculations.]*



Gravity clues, by visual and postural feedback, orients people in space. To find which clue was strongest, Brooklyn College scientists tied people to tilt chair in tilt room. Surprisingly few were disoriented.

**Visual perception:**

## Which way is up?

*Experimental psychologists are isolating—and playing tricks on—human senses with an array of curious devices to learn why people see things as they do*

by Jeanne Reinert

**Y**ou are whirling around in a space capsule, gravity-free. Which way is up? Down? You can walk on the ceiling or the walls of the capsule as easily as the floor—

they all seem the same. Can you read the dials correctly? Do your eyes deceive you? Looking out the window, you see the rendezvous spaceship. How close is it? There are no clues, nothing to tell you whether it is 50 miles or 50 yards

from your position.

Someone walks down the hall, but the tilt is as though they're going "swanchwise"—from beam to gutter on a roof. Does the right foot have to land higher than the left one? Which way do the doors swing, in or out, as gravity tugs them downward?

You look through a small window into a square room. One man's head grazes the ceiling as he towers taller than the door frame. In a corner of the same room, not 10 feet from him, stands another man who comes only halfway up the door. You look away, dazed. You look back and the two men have switched places—and sizes. Now the giant is small, the little man pushing against the ceiling. What sort of Alice-in-Wonderland trickery is this? It's no fiction. These effects are being produced in a number of laboratories today.

The kindred problem in each case is perception. How do you gauge up and down, relative distance, whether you're looking at a space capsule or a football game?

Most people think that the sense organs furnish the brain with a carbon copy of the world outside. In other words, if you are sitting beside a swimming pool, you are equally aware of the warm sun beating on your shoulders, the sound of lapping water, racing swimmers and the color of water and pool.

Anyone who has tried to photograph sunbathers knows that we do not see things as they appear. Just look at the giant feet and little heads in the picture. Yet, to the photog-

rapher at the poolside, the feet and heads were not out of proportion. We do not see as a camera does.

The same observation holds for distance. If a person walks along a street and sees a friend at the other end, the friend looks only two inches tall. As he approaches, the viewer does not perceive the friend doubling in size with every few steps. Yet, to the sight, he does just that. How do we learn to perceive the world about us?

### Touch before sight

A long-cherished notion of perception was first set forth in the 1700's. At that time, Bishop G. Berkeley contended that an infant learns a ball is round—not by looking at it—but by feeling it. Until the baby actually handled the ball, the sight of its roundness was meaningless. As the baby explored more and more of his surroundings by touch, his idea of the world grew accordingly and in three dimensions. Touch educated vision.

In a classical experiment, George Stratton of the U. of California wore glasses all day that turned the world on its head. At first he tried to duck under objects that he should have climbed over, he reached up when he should have reached down and so forth. After a few days, however, he could correct for the upsidedown vision and adapt his movements. By the end of a week, he was fairly efficient although the world never felt altogether right. Now, if we learned about the world through touch, his



Prism glasses tilt the world for whoever wears them. A walk down a corridor while wearing them would look like the picture above. They slant everything to a 30-degree angle. After five minutes of wearing the glasses below, most human guinea pigs exhibited a noticeable amount of adaptation, learning to walk crooked.



adaptation would be expected. In another experiment, prism glasses reverse left and right. Adaptation to this follows a brief period of trial-and-error. If an infant learns to see through touch, then an adult could relearn how to see when his sense of touch informs him that his eyes are falsely informing him.

Several experiments in recent years, however, have discounted this theory. They suggest that some visual knowledge is "wired in." In one experiment chicks have been hatched and raised in completely dark quarters. They have no chance to use touch experiences to check visual information. Yet, when they are placed on test stands in a lighted area, the higher the stand, the longer the chick will delay in jumping off. If visual perception depends on prior touch, the chicks would have no way of knowing it's more dangerous to jump from high stands.

Likewise, human infants display similar abilities as soon as they are able to move about on their own. If a visual cliff is created by placing a piece of glass on top of a piece of checkerboard linoleum, with half of the pattern appearing normally and half appearing to plunge abruptly, infants will avoid the visual cliff. This is a purely visual depth cue as the glass, to touch, is identical over the cliff or level portion of the pattern. Not only will ordinary children avoid depth dangers, but by 18 months, so will children who are one-eyed from birth. These experiments, made by Eleanor Gibson of Cornell and Richard Walk of

George Washington U., make the claim that both eyes are necessary for depth perception very dubious.

This does not mean that we learn by sight alone. To prove this point, R. Held and A. Hein devised a kitten carousel. Kittens were kept in pairs in the dark except for one hour a day. During that time, one kitten was hooked in a harness as it moved about: its motions caused the other kitten, hooked into the carousel, to follow in an identical path. Thus, the two shared all the same visual experiences. The passive kitten was later allowed to move about under lights and showed marked inability on the visual cliff or wherever depth perception and eye—muscle coordination are needed. Only the active kitten could coordinate his motions and sight. So, moving about is necessary to coordinate properly.

One important method for gauging distance is convergence. That's what your eyes do when it appears that tracks run together in the distance or someone on the far side of the room seems smaller than a person nearby. Persons learn to judge distance from the perspective they gain from the degree of convergence. This learned judgment made it possible for Princeton researchers to build a room that made it look as though persons either grew to giants or were unsanforized. The room is shaped like a pyramid laid on its side with its top cut off. Floor and ceiling fan out sharply to the left so it is about twice as high as the right. The left side is twice as deep

as the right side. The windows and doors increase in size on the high left side. The result is a room that appears square because the normal perspective is destroyed. Thus, people on the left look small and short as they stand 16 feet from the viewing peephole. People on the right, only eight feet from the window, graze the ceiling but appear to be on the same plane.

### Gravity keeps us upright

Space travel has turned what once were academic theories into serious concerns. The body normally uses gravity to keep tabs on its position. Normally, visual and postural feed back tell an individual which way is up. To learn which was the stronger cue, several experimenters have used a small room with a chair in it. Chair and room can be tilted independently. The experimenter causes the chair and room to tilt to set positions. The subject then must adjust either his chair or the room to the true vertical. The findings of a Brooklyn College study were that, on the average, people adjusted the chair to a compromise position between the true upright and the visual field. There were extreme individual differences. Then a Tulane U. group tried a similar experiment. However, subjects were carefully instructed as to what posture cues to note. As a result, they were able to align themselves to within two degrees of the vertical upright.

Before the space flights some ex-



Anechoic room is so quiet subject can hear her own heartbeat. Equipment attached to chair measures accuracy in locating sound sources. Study found that head rotation helps locate front and back sounds; pivot motions distinguish sounds above, below.

In the visual perception test below, distorted visual cues are at odds with body's natural sense of the upright. When the subject, seated upright, tries to make tilted electro-luminous line vertical, he aligns it with frame and he begins to feel tilted.



perts speculated that perception would be seriously disrupted. They were concerned that lack of gravity and acceleration would upset vision. There was the possibility that the eyes would deceive astronauts in reading dials or that "greyout" (loss of peripheral vision) would occur. To test for such eventualities, astronauts were spun on spintables, dangled by the feet and subjected to ride on a vast array of equipment.

But, in space, few of the expected malfunctions occurred. Spacemen have been able to adjust perceptions better than anticipated.

Spacemen have agreed that the color of land, water and clouds from spacecraft is similar to the view from a high-altitude plane at 50,000 feet. Vision is really clear. Scott Carpenter, for example, was able to pick out a dirt road over El Centro, California, and noted, "... the impression that, had there been a

truck on it, I could have picked it out." Andrian Nokoleyev, a 1962 cosmonaut, said he could distinguish not only city limits but also the main streets.

However, to spacemen, the ship stands still and the stars and moon float past the porthole. Astronauts always know where they are with respect to the spacecraft, but at times lose orientation with respect to the earth. John Glenn, for instance, noted no special problem in keeping oriented but relied more strongly on visual cues than in an airplane. When the horizon is not in view, it is difficult to distinguish up from down positions. However, this has never bothered an astro-

naut. Scott Carpenter drifted about during his mission and was undisturbed. External references were out of sight, but the earth would appear from time to time. The only clues he had for motion and weightlessness were visual, according to a first-hand report compiled by Captain Donald Zink. He notes that much of the information on visual perception is anecdotal and more experiments are needed to verify the astronauts' tales.

The more that is known about visual perception, the more puzzling it has become. For those in space and for the earthbound, the age-old question of how real is the world we perceive is still fascinating.

### Answer To baseball problem on page 13:

#### Data used by author

Vertical distance baseball dropped .....	$s = 521$ feet.
Pull of gravity .....	$g = 32.3$ ft. per sec. per sec.
Weight of ball, $5\frac{1}{2}$ ounces or .....	$w = 5\frac{1}{2}$ pounds
	16
Mass of ball, $m = W/g$ .....	$m = 11/(32 \times 32.2)$
Velocity of ball at the ballplayer .....	$V^2 = 2gs$ $V = 183$ feet/sec.
Time ballplayer required to stop the ball .....	$t = 5/183$ seconds.

To compute the force of the ball at the ballplayer we have to go to the ballplayer on the ground and use two formulae:

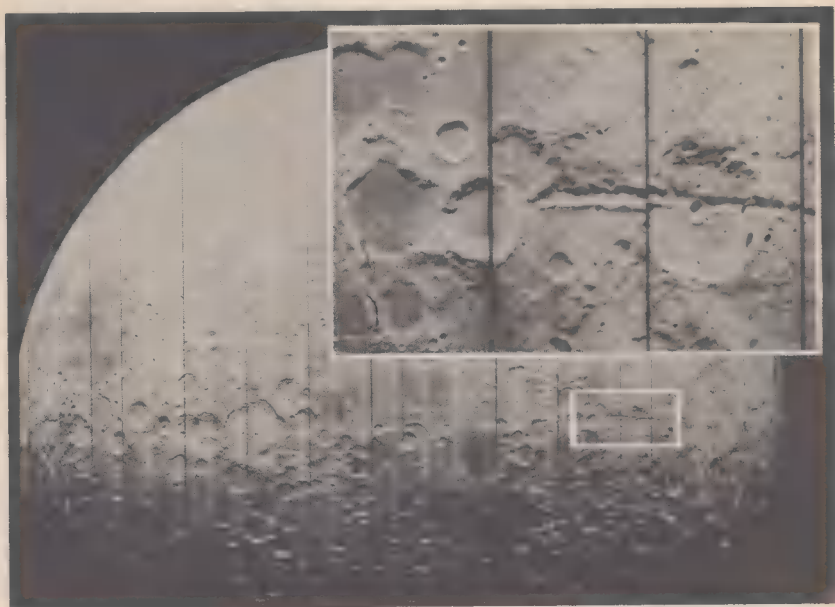
Velocity = acceleration X time:  $V = at$  from this we get "a"  
to use in second formula  $F = ma$ .

$$a = V/t = 183/.5 = 6698 \text{ approx.}$$

$$183 =$$

$$F = ma = (11/1030) \times 6698 = 72 \text{ pounds approx.}$$

P.S. Dave Coble had one year with the Phillies, caught 15 games and hit 280. Then he went into the U.S. Air Force. I've often wondered if he or the onlookers ever realized what would have happened that day if he'd missed the ninth toss under which he was standing squarely.



## Far side lunar spectacular

THE first vivid details of the terrain on the hidden side of the moon turned up some big surprises in mid-May, when NASA's Lunar Orbiter IV dutifully relayed the remarkable pictures it was taking.

The large photo above was received by Goldstone at 12:45 PM PDT, May 12. The spacecraft was 1850 miles above the moon when it was shot. "Far side" features are at right, near the moon's South Pole.

Biggest surprise was discovery of a huge trough with raised rims (inset). It's 150 miles long and a maximum of five miles wide. Located about 65° south and 105° east, it cuts through several older craters and its freshness indicates that it is

relatively young—though older than the small crater that straddles one rim. Scientists believe it may have been induced by shock from the impact which created the crater. Volcanic material erupting along the fracture may have added the rims and produced crater-like areas.

The trough is larger and appears to be much more recent than most of the similar features which have been observed on the front face of the moon and may, therefore, furnish geologists important clues about the nature of such troughs.

Lunar Orbiter IV, one of a series of NASA space research vehicles, is making a photo survey of 95 percent of the lunar surface.



## MEDICINE

Bulbous red nose is a sign of liver trouble due, from varied causes, to lack of nicotonic acid.

# How your skin reflects your health

*Human skin provides external evidence of many ailments within the body. By reading such signs correctly, a physician can often prevent pain and suffering—even death.*

by Thomas Sternberg, M.D.  
Professor of Dermatology, UCLA  
as told to Andrew Hamilton

**H**UMAN skin is far more than just a flexible bag containing a watery human package. It is a device that allows man to adjust to his environment. It is the first line of defense against bacteria, viruses and fungi; a thermostatic marvel whose sweat glands and cutaneous blood vessels regulate the human body at a temperature of 98.6 degrees Fahrenheit; a super-switchboard that receives and transmits such vital information as "this shoe is too small" (pain), "the stove is warm" (heat), "the air is nippy" (cold), and "the cat has soft fur" (touch).

But there is another important

function of skin that most people do not know about—or if they do, often disregard. It is the ability of the skin to act as a "trouble panel" that flashes warnings of ill health and disease to both doctor and patient.

Not long ago dermatologists were sometimes slightly referred to as "externalists" because they were expected to treat outward symptoms of disease only. But in a dozen or more top medical centers in the United States a new trend has set in. Dermatologists work side by side with internal medicine specialists. With such a background they are often able to predict what is happening *inside* the body from what they observe on the *outside*.

Today about 2,000 physicians, certified by the American Board of

Dermatology, are trained to know that abnormalities of the skin may be superficial—or that they may signal the onset of systemic disorder.

Before we discuss a few of the outstanding examples, let's take a look at a few remarkable facts about this material which, in actuality, comprises the largest organ of the body. Its functions are as vital as heart, lungs or kidneys.

### Skin facts

- Human skin averages  $\frac{3}{16}$ ths of an inch thick—ranging from a delicate  $\frac{1}{32}$ nd of an inch on the well-manicured eyelids of a movie starlet to a tough  $\frac{3}{4}$ ths of an inch on the calloused sole of an Australian bushman's foot.

- An average adult's skin weighs about six pounds, and if spread flat would cover about 18 square feet.

- If you should fall down and rasp off a piece of skin the size of a 25-cent piece, you would lose one yard of blood vessels, four yards of nerves, 25 nerve ends, 100 sweat glands and some 3,000,000 cells.

The skin itself is subject to a long list of diseases, among them—athlete's foot, boils, calluses, corns, eczema, hives, impetigo, pimples, ringworm, warts and insect infestations. In addition, there are certain specific conditions of skin that alert a dermatologist to more serious trouble within. Here are ten of the most important such signs:

1. *Rash*—The No. 1 cause of skin troubles is nervous disorders, which trigger about 40 per cent of

all skin diseases. Ordinary neurodermatitis, which medical men know by the more complicated name of *lichen simplex chronicus*, represents an escape valve for the human nervous system. Its distinctive characteristics show up clearly in a biopsy under the microscope.

While neurodermatitis can be cured, it may not be the best therapy for the patient. Many dermatologists agree with the noted psychiatrist, the late Dr. William Menninger, who said it may be more desirable for neuroses to react on the skin than on digestive organs or the circulatory system where they can inflict more serious damage. It is sometimes wiser, therefore, to treat symptoms rather than to effect a cure.

2. *Itching*—About half the complaints of an itching skin may also be due to nervous disorders. But there are many others. For example, itching may be the first indication of diabetes, and when this disease is suspected, laboratory tests are prescribed. Itching may also be one of the initial symptoms of a uremic condition which is related to kidney disease. Itchiness is sometimes a sign of an improperly functioning liver that fails to detoxify the blood—hence poisonous waste chemicals irritate nerve endings. An insistent itch may also be a sign of leukemia or Hodgkins' disease.

3. *Plaques*—Red or yellowish plaques on the shins—hard, rounded areas—are additional signs of diabetes. So are little reddish-yellow lesions scattered through the body.

4. *Yellowish nodules*—Disturbances in fat metabolism can produce xanthomata of the skin, a condition that results in a profusion of yellowish nodular lesions. Xanthomatosis is a disease that can impair the coronary arteries and other blood vessels. It can be readily detected by yellowish plaques that form on the eyelids.

5. *Tumors of the skin*—Many skin diseases result from blood-forming elements in the body. For example, malignancies of the lymph glands may show up as tumors of the skin. One relatively rare and ultimately fatal disease, *mycosis fungoides*, produces reddish tumors with a tendency to spread over the face, scalp and chest.

Darier's disease, another ailment involving blood-forming elements, is characterized by bluish nodules starting on the feet and spreading to other parts of the body.

The early stages of leukemia are indicated by itchy nodules of leukemic cells in the skin. They vary in size from that of a pinhead to that of a man's hand. In severe cases, the entire body becomes red and scaly.

6. *Redness*—A malfunctioning liver may be detected by redness of the palms or little, spider-like lesions all over the body. Liver trouble also makes the skin hypersensitive to light because of an insufficiency of nicotinic acid. Under these conditions—called pellagra—areas of the skin exposed to light become a bright red. A familiar example: the flushed cheeks and red nose of an alcoholic

whose drinking has damaged his liver.

7. *Changes in pigmentation*—Changes in skin color often are indications of disorders of the endocrine glands. A hormone in the middle lobe of the pituitary gland stimulates the formation of melanin, the substance that causes freckles. An excess of melanin in a white person can cause dark patches. Addison's disease attacks the cortex of the adrenal glands and causes brownish spots to appear on the skin as an early symptom.

8. *Change in physical appearance*—Repression of the pituitary gland by disease or prolonged cortisone therapy may bring about a marked change in physical appearance. The whole contour of the face may change. The cheeks puff out and

Itching can be the body's alarm signal for diabetes, kidney disease or even leukemia.





Freckles are caused by an abundance of melanin, formed by pituitary hormones.

the face becomes quite round—like that of a cretin.

9. *Skin cancer*—The highest incidence of primary cancer—more than 80,000 cases per year—occurs on the skin. Skin cancers are of three types: (a) carcinoma of the basal cells, (b) carcinoma of the squamous or plate-like cells, and (c) melanoma, a tumor of melanin-pigmented cells with an insidious tendency to spread rapidly.

Melanoma may appear first as a change in a mole. Because of the speed with which it metastasizes, it should be treated by a physician immediately. Early treatment is especially important where any type of cancer is concerned. As the American Cancer Society points out, approximately 95,000 lives could be saved annually if treatment were begun at the outset of this disease. The ACS also stresses the importance of seeking medical attention if *any* change is detected in a wart or mole.

Internal malignancies may also reveal their presence by changes in

the skin. In their early stages, such carcinomas may produce no internal symptoms, but since they tend to spread, cancer cells often metastasize to the skin and produce little nodules.

A biopsy of tissue from a nodule cell will reveal that there is cancerous growth somewhere in the body. In certain cases it is possible to identify the specific organ that is the center of trouble, for the nodule reproduces cells of a type characteristically found in that particular organ.

10. *Mutilated skin*—It is not uncommon for the mentally ill to mutilate their skins deliberately. They will inflict knife cuts and cigarette burns, or even gouge out flesh with their fingernails in a pathetic effort to gain attention or sympathy. After a physician has dressed the wounds, a psychiatrist should take over to help the patient reveal the cause of his self-destructiveness.

Delusions also present a problem to the dermatologist. One of the most common is that tiny parasites or insects are infecting the patient's skin. One woman threatened to kill herself because the little flakes of skin scraped from her arm did not contain parasitic creatures or even signs of infection.

"You are the thirty-third doctor who has refused to believe me," she said angrily. "I am going to write a letter to the local newspaper and tell them I am committing suicide because you won't help me to get these little parasites from under my skin."

## Chicago Man Reveals How to Make Money —writing short paragraphs



Now anyone who can write a sentence in plain English can write for money without spending weary years "learning to write."

For many years now, thousands of amateur "spare time authors" have been selling contributions to magazines and earning 5-10 times *more* per word than famous writers.

Mr. Benson Barrett was one of those people. By using a method known to only a few people, he enjoyed a steady income and made enough money in spare time to pay for a fine farm near Chicago, Illinois. Finally, he decided to share his method with others. Since then, he has shown a number of men and women how to write for money—*without tedious lessons or study or practice*. And many of these people started mailing contributions to magazines *less than two weeks* after starting with Mr. Barrett's plan! He simply showed them *what* to write, *what form* to put it in, *who* to send it to.

Mr. Barrett's plan also shows you a simple method for *getting ideas* by the hundreds, and a list of more than 200 magazines which will buy short paragraphs from beginners. In short, he shows you a method,—a plan for starting to write right away for money.

If the idea of getting paid for writing short paragraphs appeals to you, send a card today for full particulars, Free. No salesman will call on you. Write: Mr. Benson Barrett, 6216 N. Clark, 377-V, Chicago, Ill. 60626.

If you detect any of the 10 symptoms described above on your own skin—and if they continue to persist—see a doctor without delay. Prompt medical attention can save you much discomfort and suffering. It may even save your life.

What are the characteristics of a healthy skin?

It has an elasticity that keeps it firm but flexible. Normal skin color varies, of course, according to the pigmentation characteristics of an individual's race and heredity. Skin temperature is usually more or less consistent with room temperature—or about six and one-half degrees less than body temperature. Normal skin, contrary to popular belief, is on the acid side. Sebaceous glands secrete just enough oil to keep the skin soft and pliable. All these characteristics vary with the individual. But color, clarity, temperature, texture and elasticity are important considerations.

The best care that you can give to your skin is to keep it clean. Ordinary soap-and-water treatment does two things: (1) it keeps the pores from becoming clogged and (2) hinders the spread of infection. Both are important to maintain an attractive appearance.

The American philosopher, Ralph Waldo Emerson, best summed up the relationship between inner well-being and a clear, healthy skin when he wrote:

*For well the soul, if stout  
within  
Can arm impregvably the  
skin.*

## NEW FOR PEOPLE



Now you can learn a language whether you're at home hooking ■ rug or in a car caught in a traffic jam. RCA Victor's Stereo-8 language series tape cartridges (above left) are designed for use in home and car players. The series covers French, German, Italian, Spanish in three levels.



It's not a space age baseball. The perforated globe at left is a "Diamond Ball," an invaluable aid to racecar drivers. Made of Bakelite plastic, the balls are used to pack a racing car's fuel tank to keep fuel from sloshing when car makes a sharp turn. From Union Carbide Corp., N.Y., N.Y.

Rubber clamp called Twinphone that snaps on phone receiver makes a three-way conversation easy. The gadget, which fits all phones, amplifies sound while cutting out noises of traffic, and crying babies. It clarifies bad connections, aids the hard of hearing. Don Hill Mail Order House, Ga.



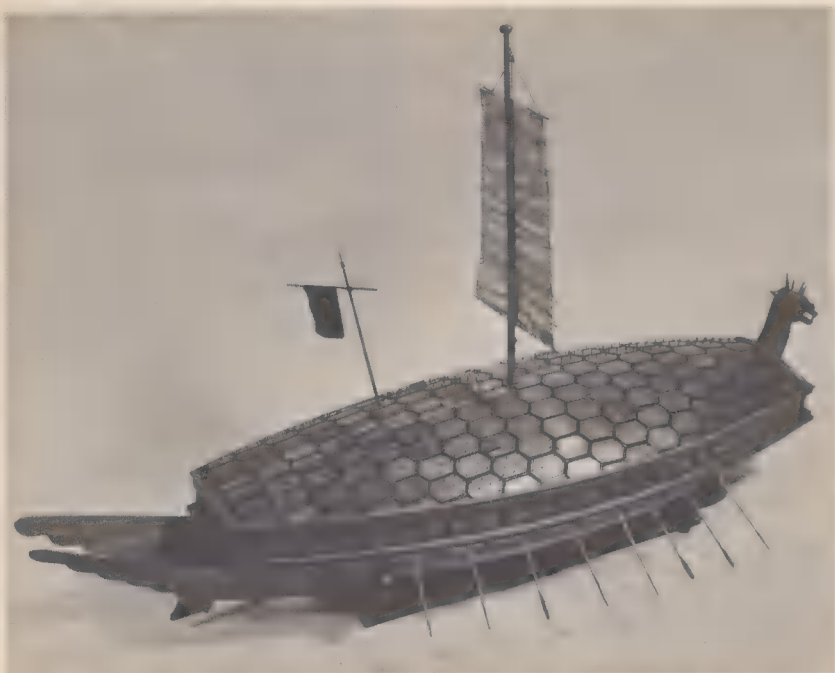
Pocket size blanket, above, weighing only 12 ounces, is made of a metallized plastic material that renders it windproof, waterproof and warmer than wool. Called SPACE Sportsman's Blanket, it has done rescue duty in Vietnam, and been a life-saver for children and climbers alike.



The paper hassle is over. Now, scholars (or anyone else) can find data from 126,000 microfilmed dissertations just by asking the computer. List of papers appears on screen. The retrieval system was developed by Xerox's University Microfilms Library Services, Ann Arbor, Michigan.

New magnetic broom that sucks up nails from lawns or gravel driveways is available for home use. Carpenter, below, tests pickup of sweeper's alnico magnets. When broom is loaded with nails, user pushes neoprene ring across the magnetic bar to wipe it clean. Indiana General Corp., Wis.





Copper-covered Korean "turtle ship" looks more like a gleaming dragon in this picture and in actual battle probably seemed like one to the 375 Japanese war ships destroyed by the Koreans in the 16th century. Invulnerable shell predates Civil War iron battleships.

## Science Month

### Monitor—Oriental style

The tendency to assume that our great technological breakthroughs are always "firsts" has had more than a few rude shocks. A recent gift from the Republic of Korea to The Mariners Museum in Newport News, Va., provides another: Our first iron battleships, the Monitor and the Merrimac, were "old hat" by nearly two centuries!

The gift, presented to the mu-

seum's director, Rear Admiral George Dufek of Antarctic fame, consists of a beautiful three-foot model of a Korean "turtle ship." The unusual vessel was one of a fleet that enabled the Korean Navy to destroy Japanese invasion forces during seven great naval battles between 1592 and 1598, in which the turtle ships sank 375 Japanese ships of war.

Designed by Admiral Yi Soon-Sin, the turtle ship was built to

resist all methods of attack known at the time. The bottom plate was copper-sheathed; 64 feet long, 11 feet wide at the bow, 14 feet amidships and 10 feet at the stern. Seven foot copper sides were added. The hull was then covered with iron plate in the shape of a turtle back, making the craft invulnerable to cannonballs, arrows and fire. Sharp,

upright spikes bristled from the deck to repel boarding. The ship was propelled by 20 oars. It carried 52 guns and had ports through which archers could shoot fire arrows.

To increase the turtle-like appearance, a huge carved head and neck of a symbolic turtle was added to the bow of each warship.

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## Scientific "gold rush"

A huge mass of gold-bearing rock, estimated to total 50 cubic miles or more in the Jackson Hole area of northwest Wyoming, is a special target of investigation by scientists of the U.S. Interior Department's Geological Survey.

In an early report on the area, geologists said that a newly-developed analytical method for detecting very small amounts of gold was used successfully to test this vast series of gold-bearing rocks. The gold is in sandstone and conglomerate that were deposited as river sands and gravels 10 million to 70 million years ago.

Dr. Harold L. James, chief geologist of the Survey said, "first results on about 1,200 samples collected from widely scattered localities throughout the various rock units show that all the units contain gold. The gold content in large units of the rocks ranges from 6 cents to 35 cents per cubic yard and we find these preliminary re-

sults encouraging because they suggest that, with further research, richer zones can be found and will become target areas for exploration by private interests."

James noted that some of the individual samples contained more than \$3.00 worth of gold per cubic yard, and that the development of new mining and recovery methods could make the deposits economically workable.

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## Computed highway

The vision of superhighways and expressways springing up overnight eventually may be more than just a metaphor.

A computer now is helping England's Ministry of Transport spearhead a new M-62 superhighway across the Pennine mountains in Lancashire and Yorkshire.

Britain's first transmountain highway project, the M-62 route was chosen as the most direct and economical. Unfortunately, it is also a very tough terrain to cross.

Boundaries of agricultural land and established property, preservation of landscape features, minimum cut and fill, easy flow of cross traffic were some of the problems that had to be linked into the Honeywell 400 computer program. The computer screened an array of possible routes and levels, and tested alignments, gradients and curves. Bridge designs were also included in the M-62 computer program, including the 500-foot-long Scammonden bridge.

The speed and thoroughness of the computer technique, while not lowering Britain's spiraling expenditures for highways and bridges (\$12 million to \$60 million yearly), keeps costs close to the line.

### Pint-sized "Surveyor"

A seventeen-year-old high school senior has duplicated the feat of Surveyor One's soft landing on the moon. As a tribute to his talents, Hughes Aircraft Company (they built Surveyor) awarded him a \$5000 college scholarship, a trip to California and a summer job at Cape Kennedy.

Using a Woolworth assortment of equipment and the ingenuity of a young Edison, Ron Lagoe, an aspiring astrophysicist from Oswego, N.Y., launched his two-pound Surveyor-R October 18, 1966, and brought it to five successful soft landings in his backyard.

He carefully constructed his two-foot model from 1/2-inch maple doweling for support material, epoxy paste and Elmer's glue as bonding

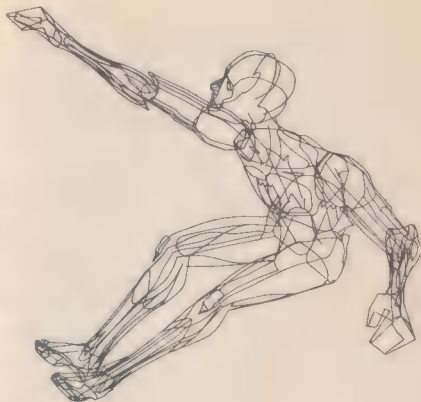
agents, foam rubber for the footpads and ping-pong balls and cork fishing bobbers covered with aluminum foil as dummy fuel tanks. But preliminary tests are a must before actual experiment. Mr. Lagoe took those precautions with a proof-test model built for the purpose. He weighted it, mounted it with tiny rockets and launched it with helium balloons which he then cut loose to made over 60 test landings from short drops to plummets from 500 feet.

When it was ready for the real firing, Lagoe equipped his Surveyor-

Model Surveyor, built by Ron Lagoe, made a soft landing and won a scholarship.



Animated line drawing of a human body (right) is the product of a new "art" called computer graphics. Electronic drawings are done by a machine which was previously used in commerce to calculate mathematical problems. Now, instead of calculus, the computer has to link together the intricacies of human anatomy, translating data into lines for a graph or a drawing which is then produced on paper, tapes or film. The figures are a help to scientists working in human factor studies because seven separate systems of the body are articulated clearly and precisely for easy observation. Physically flexible, the process can draw a body in almost any position, from a relaxed sitting pose to an extreme reaching position.



or-R with a small radio transmitter, armed the rockets and began the mission with a free fall from 85 feet. Retro-fire started at 53 feet above the ground.

"After retro-fire, a marked decrease in spacecraft velocity was noted until retro burnout occurred at 20 feet and the verniers burned alone," he observed. "Complete counteraction of gravity was achieved at two feet, after which vernier shut-off occurred and the craft dropped to the surface."

Not only did he accomplish his main objective—construction of a  $\frac{1}{7}$  scale model of the Surveyor and development of retro and vernier rockets for a shock-dissipating soft landing—but with the radio transmitter he built and installed, Ron was able to maintain continuous communications with the spacecraft during descent. According to his report, after the touchdown, communication was maintained for a

period of 66 hours, 24 minutes and two seconds—about 42 hours better than he'd hoped for. A bimetallic strip hooked to the transmitter also relayed temperature data to the craft's "station" on earth.

### Sharper eye on hurricanes

The hurricane season starts later this month and the tropical troublemakers will be studied more closely than ever. Work at the National Hurricane Center in Miami will be put on a year-round basis. Previously the center operated only during the hurricane season of June to November.

Experimental seeding of storms will continue, although thus far these efforts to reduce the destructive powers of hurricanes have met with indifferent success.

In addition, a specially equipped tracking ship to trail hurricanes will be added to the center.

## *Tips and Trends*

Living heart transplants in people come closer to reality. Dr. Richard J. Cleveland of Medical College of Va., has transplanted hearts from dead dogs to live ones. Of 10 cases, eight dogs lived more than 48 hours after surgery. Meantime, at Deborah Hospital in Brown Mills, N. J., half a dozen human victims of aortic valve damage have undergone successful transplants of calf heart valves.

People with the shortest tempers are laborers and office workers, according to a report on anger in the Journal of the American Medical Association. Slowest to boil were professional types.

Ammonia may be the fuel of the future in power plants and turbine-drives, reveals Leon Green, former scientific director of the Air Force's Research and Technical Division. Reason: its exhaust products are largely water vapor and nitrogen -- two components of ordinary air; hence, no pollution. Problem: it's volatile, poisonous and hard to handle. But benefits might spur research.

After effects of the recent Florida drought are expected to create greatest impact in the Everglades later, rather than sooner. "We lost our brood stock," explains Park Superintendant Roger Allin. "We won't feel the effect for some years, but it will be serious." Dried-up 'gator holes are where fish bred; the fish fed 'gators, birds, otters, raccoons, bobcats and other wildlife.

Late summer and early fall is the best time to plant lawns -- gives them a head start against the spring weeds. Experts recommend red fescue, rough bluegrass and St. Augustine grass for shade; Kentucky bluegrass, bermudagrass, carpetgrass in sun.

Avoid decimating honey bees with pesticides, warns the U.S. Department of Agriculture. Here's how: (a) use granules or spray - not dust. (b) treat before or after flowering, and at night. (c) use pesticides least hazardous to bees.



Manatee (left) was enticed from his diet of weeds and customary invisibility by a delicacy: a tomato. Blubbery-lipped mammal is alleged to be "mermaid" of sea legend.

## Manatees—living lawn mowers

**L**IKE many a suburban homeowner battling the creeping crabgrass, boat crews from Florida's Flood Control District are in a lather—spraying, plowing and swearing—to keep weeds from clogging vital canal networks in the central and southern portion of their state.

But the FCD thinks it has the answer to its curses—a living lawn mower called the manatee.

More commonly known as the sea cow, these blubbery behemoths can devour 100 pounds of underwater

plants a day. That amounts to ploughing through a half mile of weed-clogged waterway in one week.

How quickly and effectively five manatees can scour the 1300 completed miles of the FCD system of canals criss-crossing Florida is the subject of a study by Florida Atlantic University, financed by a \$34,000 grant from the Central and Southern Flood Control District.

The FCD network (18 counties) includes canals and lakes that carry flood waters in the rainy season and supply irrigation and mu-

# POSTED

NO FISHING

ANCH

**MOLESTING  
INJURING, KILLING  
OR TAKING OF  
MANATEES or  
SEA COWS  
IS  
STRICTLY PROHIBITED  
By Florida Laws**

*Ernest Mott, Director  
State Board of Conservation*

The fenced-in canal that serves as a test zone for the sea cows' weed cleaning is situated well away from highways and houses to keep invaders from disturbing animals.

nicipal needs during drought. But for years "floating" plants such as the water hyacinth, and underwater weeds—elodea, coontail, alligator weed—have multiplied enormously, choking water arteries that cover nearly 80,000 acres of Florida water surface. Aside from making the waterways unnavigable, the weeds have ruined fishing and killed more desirable plants.

Chemicals and underwater mowing machines have proved successful only for short periods of time. They cost \$140,000 yearly and herbicides can be lethal to wildlife.

The five manatees in the three-year FCD project are being scrutinized on these points in a laboratory environment. They are sequestered in a fenced-in section of



Section of canal system in Everglades shows typical overgrowth of hyacinths and aquatic weeds that clogs Florida's flood control and irrigation canals.

a canal where weed growth is typically obnoxious. So far, the animals have gobbled up enough weeds to make many waterways passable, but some state officials have misgivings about the sea-going monsters' ability to maneuver in the small drainage ditches and secondary canals. Sea cows weigh in from 350 pounds to a ton, a heftiness which may not hinder progress in major waterways but would make it a tight squeeze in the minor ones.

There are other difficulties attached to using manatees as weed-killers on a large-scale basis. Once plentiful on the Florida coast, they've been hunted almost to extinction by man for food, because the flesh is rich and meaty. Now a fine and a jail sentence is handed

anyone caught molesting one. They are also slow breeders and chemical inducements may be used to flesh out their numbers. The beast has to be accustomed to living in fresh water and will have to be nursed through Florida cold snaps.

The idea of using sea cows as lawnmowers was initially scoffed at by the FCD, but reports of successful experiments with manatees in British Guiana prompted Ed Dail, director of the FCD, to look into the matter. Results of his investigation looked promising. The Miami Seaquarium was asked to send a fully rigged ship to net six

manatees for study.

Despite their bulk, the creatures proved surprisingly elusive. Since they prefer turbid water to live in, they can be invisible under a foot of water. Air-breathing animals, they surface once every 10 or 15 minutes, poking only the tip of the snout out of the water. After two weeks' search, the Seaquarium crew managed to bag five in the Miami River.

If the FAU research team can solve the problems, the seacows' eating talents may be put to work in weed-infested canals in other tropical countries.



White shadows of three sea cows are just discernible underwater as the huge mammals comb the last of three separated canal sections for the submerged weeds they love to eat. They've already cleared two quarter-mile sections of hyacinths.

One of the five experimental manatees—difficult to photograph and harder to catch—is being lowered by crane into one of the test sections. Artificial crossings divide the canal, but fenced tubes keep the water flowing from one part to another.



# Cities under the ocean floor

*"Two-thirds of the world is up for grabs," points out a Navy scientist. He proposes our populating it with gigantic rooms carved from solid rock under the seas.*

by **Bruce H. Frisch**

"CARL Austin?"  
"Yes," said the man, swinging around.

I had never seen him before, but at six feet three, chesty, with boots, a Western string tie and sideburns, there was no mistaking him standing in the middle of a Washington hotel lobby. Dressed like that, even though a Ph.D. (in geological engineering) working for the Navy, he certainly made a point of being himself. But what would you expect from a man who, when the rest of us are agog at the prospect of Sea-Lab III going down 400 feet into the ocean next January, was talking about drilling down through the ocean floor 1,000 feet into bedrock, then carving out huge caverns that could be anything from secret bases to oceanographic research stations to protected work sites from which to drill deep ocean oil wells? He calls his scheme Rock Site, and he spent the next few hours explaining it.

In the first step, Rock Site I, he would tunnel out under the ocean

from shore and punch up through the ocean floor, where he could erect a stubby tower to which submarines could attach for the transfer of men and supplies.

Rock Site II would be completely isolated from land. Rock Site III would be under 1,000 feet of water and would have a sail-in lock so submarines could motor into the entrance tunnel and surface inside. As submarines and elevators for divers are made to stand depths greater than 1,000 feet, Rock Sites

The man with the plan, Dr. Carl Austin, is an expert for the Navy on what explosives will do to various kinds of land surface.

Bruce Frisch





Official United States Navy photograph

A cutaway of the ocean bottom reveals a Rock Site beneath. At the lower right ■ boring rig continues to chew its spiral way through the solid rock. All debris could be mixed with water and pumped to the sea floor. In the center, submarines prepare to fasten onto main entry hatch; at upper left a submarine zooms away from a back door.

In an advanced Rock Site subs could sail right in. Here, at the base of a seamount, a sub would first nose its way into the outside cone which would guide it into a tight-fitting lock. Then the outside door would close, the inside door open, and the sub would motor into the larger diameter pond to surface in air at one atmosphere pressure.

Official United States Navy photograph



could be moved into deeper water.

Up to now the Naval Ordnance Test station, China Lake, California, where Austin works, has paid for the study and a three-dimensional geologic survey of a location for Rock Site I off the shore of San Clemente Island in California. Austin was in Washington for a meeting to discuss the bigger money, \$20 million, needed for construction. When asked about the meeting later, he said he was, "Pleased."

Many dreamers and far-out thinkers like Buckminster Fuller of the geodesic dome have drawn up plans for living on or in the water (see pages 40-41). A few could turn into working realities: The thin-skinned structures with an internal pressure equal to the surrounding water such as the Navy's SeaLab; Edwin Link's SPID; Jacques Yves Cousteau's various Conshelf houses; the Navy's "bottom-squatters" being developed at Port Hueneme, California; and General Electric's Bottom-Fix, one-atmosphere glass spheres strung together like beads. Something like Rock Site is an oil storage chamber hollowed out of the floor of the Persian Gulf under 90 feet of water and 90 miles from land. It has been designed by an Oklahoma firm for a consortium of five oil companies, who now can't agree to go ahead. Not only does Austin leap-frog them all, but Rock Site is based on *present* technology.

This is not another Mohole that eats up millions of dollars developing new technology. Austin stresses. But a Rock Site would be an ideal



The Navy is also developing a Manned Underwater Station, nicknamed "bottom-squatter," to house five men for 30-day spells at 6,000-foot depths. This Westinghouse suggestion is made up of doughnuts with ten-foot-across living spaces.

place from which to drill a Mohole.

Ever since he was a boy in Larkspur, California, Austin has thought about living *under* the ocean bottom, although the basic idea is not original with him. A couple of years ago while attending a conference where drilling-and-boring men were reporting new techniques, he finally felt the time had come when it was really possible. So he set out to see some of the 100 or so mines that extend out under the ocean. Starting from the shore of Cape Breton Island in Nova Scotia, he was able to walk three-and-a-half miles out from shore through the Dominion coal mines where there are seven-and-a-half square miles of floor

space. Off the northeast coast of England coal mines go out to four miles. Planners propose to extend them to 12 to 15 miles. As long as they keep at least 200 feet of rock overhead, miners have found, the water above makes no difference except that it costs time and money to transport men and materials back and forth from shore. Economics, not any physical barrier, limits the seaward extension.

Encouraged, Austin checked out boring costs. A survey made a year ago showed about 75 drilled shafts over 10 feet in diameter had been sunk deeper than 1,000 feet. The deepest known drilled shaft, six feet in diameter, was carved 4,800 feet by the Atomic Energy Commission for underground atomic bomb testing in Nevada.

An example of the latest machinery is the borer the Hughes Tool Co. built for the Navajo Indian reservation irrigation project. A barrel-shaped head capable of cutting a hole over 21 feet in diameter carries rolling, toothed cutters that look like wide gears. Five 200-horsepower electric motors turn the head at five rpm while hydraulic rams pressed against the tunnel wall push forward with a force of 1.4 million pounds.

With this kind of technology Austin figured he could progress about five miles a year at about \$300 per foot. Putting together everything he had learned, Austin settled on how he would proceed.

First, he would drill a hole five to eight feet in diameter about 50 feet

into bedrock, a short enough distance to require only a few days of calm seas and no changes of drill bits. This part of the drilling would be done from a barge or drilling platform. According to a prediction by the President's Science Advisory Committee, there may be drilling packages that could be lowered to the bottom from surface vessels or submarines by 1975. Such a submerged package, says Austin, would avoid detection, particularly under Arctic ice. Locations where there is the necessary bedrock cover up to 60 percent of the deep ocean floor and 10 to 15 percent of the continental shelf off southern California. An especially poor place for a Rock Site would be around the Gulf of Mexico where there are thousands of feet of mud.

The next step is to drop a steel liner into the hole, cement it into place, cap it and pump it out. From there on all drilling would be done

Bottom Fix is a General Electric think project looking toward occupation of the mid-ocean ridge by 1975. Chains of glass spheres would provide one-atmosphere living under 12,000 feet of crushing water.

General Electric



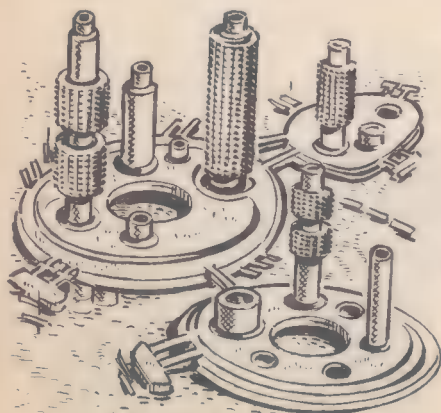
from inside. Down he'd go, mixing all debris with water and pumping it out as a slurry. Since he would be boring rather than blasting, he wouldn't have to fight air pollution. At 200 feet he would open out a temporary machinery room. Pumps, atomic generator and air supply equipment installed here would enable Rock Site to cut all ties with the surface. Then he'd start down again, to 500 or 1,000 feet where he would build the main level for living and permanent machinery. The easiest and most compact arrangement would probably be a continuously bored spiral tunnel sliced through by radials. Below this there would be only a pump and sump level where all drainage would end up.

Now back to the beginning to look at some details. At the en-

trance to Rock Site III submarines would sail into a small chamber. Then the outer door of the chamber would close behind and an inner door would open, allowing the submarine to motor forward, still submerged, into a pond where it would surface in the normal way.

There the passengers would step out into an atmosphere at sea level pressure produced and controlled by a large version of the air supply system perfected for Polaris submarines. Any coal seams encountered would absorb oxygen, and some rocks would too. Iron pyrites in one day could cut in half the oxygen in a closed room. In geothermal areas where there is volcanic activity or hot springs the walls might give off hydrogen sulfide or carbon dioxide. The remedy is simple; just spray the walls with

Japanese architect Kikutake's Ocean City rests on man-made floating platforms.



A French vision would hollow a honeycomb metropolis under the Parisian river Seine.



plastic or cement so that only the cutting face is exposed.

### Nuclear reactor for power

Power would come from a 5,000 kilowatt atomic reactor that could fit through the original five-to-eight-foot shaft. In geothermal areas like the top of the worldwide midocean ridge, it might be possible to run a power plant with volcanic steam.

Austin claims many advantages over alternative solutions. SeaLab type bottom squatters can be put almost anywhere but are easily detected. Their thin skins make them vulnerable to damage from currents, mud slides, dragging anchors, ice or enemies. More fundamentally, since the pressure inside is the same as the water pressure outside, inhabitants are bothered by all sorts

of physiological dangers and limitations.

The GE Bottom-Fix kind of structure is at one atmosphere, but it, too, is comparatively thin-skinned. And you can't put many together and keep them together; there are too many parts and joints.

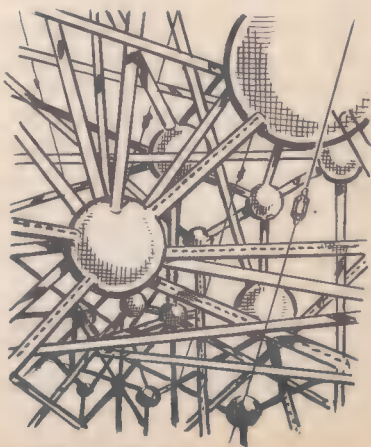
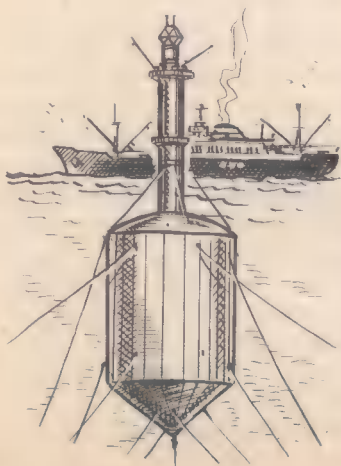
Rock Site, on the other hand, is "hard" militarily and safer in any case. If a leak should develop through the rock, one simply uses a standard mining procedure and injects a cement into the rock. This is called grouting. Many large entrances could be punched up through the ocean floor from inside, and access to all easily controlled.

When the drill was about to break through into the sea, it could be fitted with a blowout preventor, a protection device used when striking oil under high pressure. It

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Buckminster Fuller invented Undersea Island mainly as a stable oil drilling rig.

British Underwater City of architect Warren Chalk is a maze of connected spheres.



Drawing by George Blow

would prevent flooding. While the heated cooling water from the power plant might be a giveaway, it could often be hidden inside the earth by pumping into a porous layer of rock.

### Mining made easy

But Austin foresees many more uses than military ones. Based on the cost of the hole only a Rock Site should be cheaper than a mine tunnelled out from shore anywhere beyond two miles. For transportation and unknown risk, add a few more miles. Anywhere mining comes right down to the shore would then be a good bet for a Rock Site to follow the ore body out to sea. Alaska, for instance, probably has offshore copper and tin. Offshore Alaska, in ice-plagued Cook Inlet, is also an ideal spot for oil drilling from a Rock Site. Power, as in oil fields on land, could come from engines fueled by gas tapped off the wells. Along more populous coasts, suggests Austin, we could tunnel out from shore to hide atomic power plants in undersea caverns where "they would be out of sight, out of mind." At the same time, the plant could serve as a pumping station on a pipeline parallelling the coast. Many of these shallow water Rock Sites could be supplied with air and be entered through a tube to the surface and thus be able to draw power from diesel generators instead of from more expensive reactors.

At depths less than about 600 to 1,000 feet of water we are mostly limited to our own coastal areas,

because an international law that went into effect in 1964 gave each nation the right to natural resources on or under its own continental shelf. In the deeper water beyond, however, the same law "established in effect that he who uses the sea floor owns it," points out Austin. "Thus nearly two-thirds of the world is 'up for grabs.'"

Some of the first spots to be grabbed for "research" might be on the mid-Atlantic ridge and seamounts such as those between California and Hawaii, off the New England coast and in the approaches to Gibraltar.

A caution: Dr. Austin asks that when looking at the illustrations, "some degree of caution be followed in terms of 'reading into' these drawings intents and meanings we have not officially expressed."

Conclusions, therefore, are guesses.

### "Ideas come from loners"

Though, at first we must admit, we thought comfortably that Rock Site must be part of some far-sighted grand strategy mapped out by the Navy years ago. Not so.

Apparently Rear Admiral Hyman Rickover with his atomic submarine, Capt. George Bond with SeaLab, and now Austin with Rock Site have been lone men fighting for their pets. "Ideas come from individuals," said Austin, as we prepared to leave the hotel.

"I hope to take you on a tour of one of these in about three years."

# Solving the mystery of sleep

by Morris Fishbein, M.D.

WHEN conversation turns to the subject of sleep, everyone has his own ideas. And why not! By the time a person is 30 years old, he is likely to have had more than 12 years of solid sleep experience.

Before the age of 30, the average person is not particularly aware of sleep as a problem. He may toss about a bit on the night before some dreaded examination or an important football game. But he usually drops right off, and the next thing he knows, the sunlight is pouring through the window, the birds are chirping, and the aroma of coffee is tantalizing his olfactory sense.

After 30, the cares of the day refuse to fold their tents like Arabs, and sleep may become a matter of major interest. Many a man has echoed the famous remark in *Don Quixote*: "God bless the man who first invented sleep."

For assuring restful sleep, countless techniques have been recommended. In recent years, scientists

have investigated the physiology and psychology of sleep, its duration, its disturbance, and even the effect of such gadgetry as ear stopples and eyeshades.

Some of the research indicates that the person who sleeps well is often unaware of multiple interruptions of his rest. Timing with electronic devices and automatic cameras indicates that perhaps 30 seconds per hour are taken up with shifting of the sleeper's position. Some studies have shown that these periodic shifts relieve unwonted pressure on the skin.

The length of time that one may go without sleep varies from person to person. One investigator went 115 hours without sleeping, though he may have dozed momentarily during this period. The stories about notable individuals who have averaged four to six hours a night—Napoleon, Darwin, Edison—are probably true. On the other hand, many persons require eight to ten hours of sleep.

One must distinguish between rest



# Are You A 3rd-Grade Reader?

A noted publisher in Chicago reports there is a simple technique of rapid reading which should enable you to double your reading speed and yet retain much more. Most people do not realize how much they could increase their pleasure, success and income by reading faster and more accurately.

According to this publisher, anyone, regardless of his present reading skill, can use this simple technique to improve his reading ability to a remarkable degree. Whether reading stories, books, technical matter, it becomes possible to read sentences at a glance and entire pages in seconds with this method.

To acquaint the readers of this publication with the easy-to-follow rules for developing rapid reading skill, the company has printed full details of its interesting self-training method in a new booklet, "How to Read Faster and Retain More," mailed free. No obligation. Send your name, address, and zip code to: Reading, 835 Diversey Parkway, Dept. 690-018, Chicago, Ill. 60614. A postcard will do.

and sleep. An hour in a recumbent position during the middle of the day is a marvelous restorative of flagging energy. Three hours of quiet, undisturbed sleep may be more refreshing than eight hours of tossing about while the mind fusses and frets. A few hours in one's accustomed bed may be more recuperative than many hours of sleep in a moving car or train.

Many persons believe that a bedtime snack is conducive to restful sleep. Yet a report published in the *Journal of the American Dietetic Association* points out that relatively few investigators have studied the effects of activities on a person immediately before his retiring.

But investigators who conducted detailed sleep studies on 36 persons concluded that "the subjects had similar mental attitudes with or without a bedtime snack." In general, the findings support previous studies linking body movements with the type of food ingested before sleep. A light snack of cereal and milk did not interfere with sleep patterns, but hard-to-digest food resulted in increased body motility.

Since "music hath charms to soothe," music therapy has been considered a means of inducing sleep. But many who respond to the soothing qualities of music find it hard to understand why those who like music least often sleep best at a concert or an opera. Evidently, despite advances of science, many mysteries of sleep remain to be unraveled.

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# PLASTICS:

## The raw material for nearly everything

*Its water-breathing membranes will make "fish" out of skin divers; whole buildings will soon be made of it; its electrical properties will give birth to a vast new array of "goodies"—it's the stuff of tomorrow*

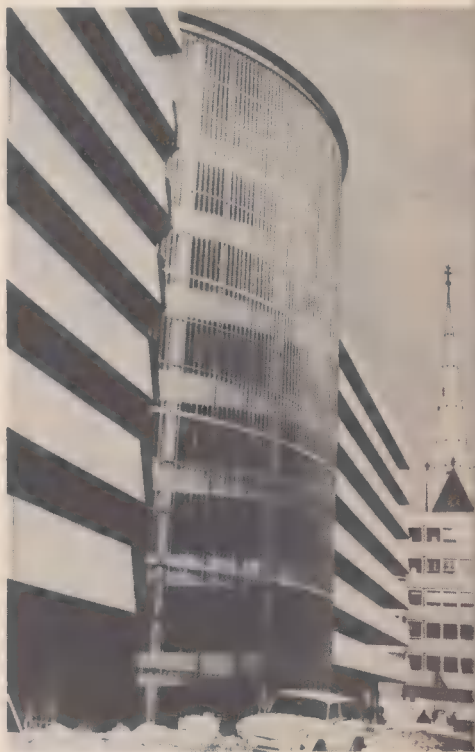
by Morton J. Schultz

IN a large industrial laboratory recently, a cowering hamster was dropped into a tank of water, sank to the bottom and proceeded to emulate the fish around him.

After 30 minutes of complete submergence, the rodent still couldn't swim a stroke. But when pulled from the pool, he was lively and happy—as if he'd spent the last half-hour in a lettuce patch. Even more amazing, the hamster was completely dry.

Had the animal undergone a new type of operation that transplanted fish gills for his lungs? No! Physically, he was no different from his cousins who watched the performance from nearby cages.

The secret behind this fantastic display of aquatic skill was an "artificial gill" of an almost invisible substance, called permselective membrane. The hamster had been placed in a sealed sack of it before being immersed. The homogeneous silicone rubber layer—thinner than paper and resembling household Saran-Wrap—will some-



Circular ramp of this seven-story parking garage in Hamburg, Germany is made of translucent Filon panels (from A. G. fuer Zink-Industrie). The panels, made of fiberglass and reinforced nylon admit diffused light while keeping ramp dry and safe.



A new heat-resistant fiber developed by Celanese Corp. (demonstrated above) is capable of withstanding temperatures of 350°F for long periods of time and retains its strength for short exposures to 1000°F temperatures. Called PBI (polybenzimidazole), the fiber is being tested for braking parachutes for high speed jets.

day allow man to breathe at the bottom of the sea, provide him with a more efficient respiratory system far out in space, and help keep him alive here on earth.

- Submarines, bathyspheres and underwater research stations when coated with a layer of permselective membrane will be equipped with breathing systems that will allow them to stay submerged indefinitely.

- Space suits coated with it will quickly dispose of trapped perspiration, which now makes life uncomfortable for astronauts.

- Miraculous medical tricks are

feasible if permselective membrane lives up to its advance notice. For example, membrane-equipped artificial lung machines for open heart surgery will use the atmosphere around a patient instead of oxygen under pressure in tanks. And it's quite possible to say that this thin, see-through membrane will someday be the basis of a mechanical substitute for a diseased lung.

In essence, the membrane distinguishes between the molecular structure of gases in a compound. Theoretically, it can be designed to allow any desired gas to permeate its one-thousandths inch thick wall, and to reject any gas that is not wanted.

Development of permselective membrane is typical of what is happening in the seething, viable world of plastics.

Today, plastic in one form or another is an integral part of your life. You walk on it, sit on it, telephone the neighbor with it. You shave with it, brush your teeth with it, paint with it. Your wife cooks in it, your kids play with it. You drink from plastic cups and eat off plastic plates on picnics. You use a plastic hose to water the lawn, and carry your clothes on trips in plastic luggage.

Have you heard of PVC? It stands for polyvinyl chloride, and is fast becoming the hottest thing to hit the home building industry in years. It comes in 10-foot length panels of clapboard-style siding. You nail it directly to your home's present siding, whether that happens to

be clapboard, shingle or stucco. It is completely maintenance free.

Solid vinyl siding never has to be painted. Its color extends clear through the material from surface to surface. There's no peeling, chipping, blistering or fading.

This plastic won't dent, scar, scratch, corrode or stain. Nor will it warp, crack, split or rot.

It's impervious to salt air, most chemicals, air pollutants, mildew and rust. It retards fire and doesn't have to be grounded. Not only is it available as siding, but also as gutters and downspouts, shutters, roof edging and soffit.

Right now, plastic building products are more expensive than established competitive materials. The siding costs 25 percent more than aluminum and is double the price of coated fiber board.

Hunter is well protected from cold wind by 11-ounce NRC Space blanket used as a wind break behind him and snugly wrapped around his knees. The blanket—developed from super-insulation used in spacecraft—fits in a pocket. (See *New for People*, p. 26) It can also be used as an auto accessory or as a radar reflector.



In time, however, this drawback will be licked. Cheaper production methods are in the works. One such method uses oxygen from the air to produce a whole new family of inexpensive polymers that are strong and easy to handle. According to Dr. Guy Suits, vice president and director of research for GE, "the new and better polymers now on the way will compete not only with a variety of metals but also with paper, glass, lumber and other materials we commonly think of when we want to build something."

The new materials withstand temperatures in excess of 370° F. and can be molded, machined and extruded into rods, slabs, sheets and pipe. One building product now being made from it is called PPO pipe which, Dr. Suits predicts, eventually will replace copper pipe in homes and factories.

From basement to roof, then, the home of the 1970's promises to be loaded with plastic. And speaking of roofs, a forerunner of residential roof skylighting could well be the shatter-resistant, weather-resistant acrylic domes now being widely used in commercial and institutional structures. This same material will probably adorn many a home swimming pool in the form of a retractable dome. Open it up in the summer . . . close it off during inclement weather and in the winter.

But many of the plastics coming up are more exciting than anything we've yet seen. For instance, up in the laboratories of the Institute  
*(Text continued on page 50)*

## ABC'S OF PLASTICS

Name	Characteristics	Typical Uses
Acetal (a thermoplastic)	<ul style="list-style-type: none"> <li>• Rigid, but not brittle</li> <li>• Resists temperature, humidity, most solvents</li> <li>• Provides products that are extremely strong with outstanding tensile strength and stiffness</li> </ul>	Auto fender extensions and instrument clusters, gears, bearings, plumbing fixtures, moving parts for appliances and business machines
Acrylic (or polymethylmethacrylate) (a thermoplastic)	<ul style="list-style-type: none"> <li>• Excellent optical clarity, dimensional stability, strength</li> <li>• Resists weather, electricity, chemicals</li> </ul>	Auto tail-light lenses, street light reflectors, plaques, medallions, outdoor signs, camera and slide viewer lenses, TV camera lenses, costume jewelry, airplane canopies
Acrylonitrile-butadiene-styrene (ABS) (a thermoplastic)	<ul style="list-style-type: none"> <li>• Tough, hard and rigid</li> <li>• Outstanding impact strength</li> <li>• Heat-resistant</li> <li>• Resists acid, alkali, salt and other chemicals</li> <li>• Good over-all electrical properties</li> </ul>	Pipe, luggage, small appliance housings, wheels, football and safety helmets, valve bodies, refrigerator parts, battery cases, auto grilles, consoles, arm rests, instrument clusters
Alkyds (a thermoset)	<ul style="list-style-type: none"> <li>• Excellent dielectric strength</li> <li>• Resists moisture, acid, ketone, ester</li> </ul>	Paint additive, molded parts for auto starters, fuses, light switches, electric motor insulators, TV tuning devices
Allylics (a thermoset)	<ul style="list-style-type: none"> <li>• High dielectric strength</li> <li>• Excellent electrical properties and insulator</li> <li>• Highly stain and weather resistant</li> <li>• No moisture absorption</li> </ul>	Electrical connectors, lamination and overlay for plywood, hardboard and particle board
Amino (a thermoset)	<ul style="list-style-type: none"> <li>• Rigid</li> <li>• Dimensionally stable</li> </ul>	Tableware, buttons, hearing aid housings, paint additive, plywood adhesive
Casein (a thermoset)	<ul style="list-style-type: none"> <li>• Strong, rigid</li> <li>• Resists impact and flexing</li> </ul>	Buttons, buckles, adhesives, toys
Cellulosics (a thermoplastic)	<ul style="list-style-type: none"> <li>• Toughest of all plastics</li> <li>• Can be made transparent, translucent, opaque</li> <li>• Withstands moderate heat</li> </ul>	Eyeglass frames, toys, lamp shades, ladies' shoe heels, combs, photographic film, auto steering wheels, tubing, tool handles, moldings, fabric coatings, vacuum cleaner parts
Epoxy (a thermoset)	<ul style="list-style-type: none"> <li>• Good electrical properties</li> <li>• Resists chemicals, weather</li> </ul>	Adhesives, bonding agent
Nylon (a thermoplastic)	<ul style="list-style-type: none"> <li>• Resists extreme temperature changes</li> <li>• Self-extinguishing, tough, high tensile and flexural strength</li> <li>• Good electrical characteristics, low coefficient of friction, high lubricity</li> </ul>	Zipper-slide fasteners, faucet washers, gears, motor parts, tooth brush filaments, hair brushes, fishing lines, sewing threads, twine for carpeting, upholstery fabric, clothing
Parylene (a thermoplastic)	<ul style="list-style-type: none"> <li>• Chemical and solvent resistant</li> <li>• Excellent dielectric properties, low gas permeability and moisture vapor transmission</li> </ul>	Capacitor insulation, encapsulation for electronic switch-gear components and computer and numerical control electric circuits
Phenolics (a thermoset)	<ul style="list-style-type: none"> <li>• Heat resistant</li> <li>• Good electrical characteristics</li> <li>• Non-flammable</li> <li>• Poor heat conductor</li> </ul>	Cooking utensil handles, adhesives, auto distributor caps, telephone head sets, radio and TV cabinets, washing machine agitators
Phenoxy (a thermoplastic)	<ul style="list-style-type: none"> <li>• Strong, tough, ductile</li> <li>• Dimensionally stable, low permeability</li> <li>• Resists most acids and alkali</li> </ul>	Packaging, bottles, vials, knobs, drawers, electronic plug-in boards, pen-pencil bodies, adhesives, paint additives

## ABC'S OF PLASTICS

Name	Characteristics	Typical Uses
Polycarbonate (a thermoplastic)	<ul style="list-style-type: none"> <li>• High impact strength, transparency, dimensional stability</li> <li>• Self-extinguishing, oil and stain resistant, noncorrosive</li> </ul>	Housings for air conditioners, portable power tools and home appliances; street light globes, electrical connectors, water pump impellers, telephone finger wheels, rocket launcher handles
Polyesters	High strength-to-weight ratio	Primarily used as a bonding agent for reinforced plastics
Polyethylene (a thermoplastic)	<ul style="list-style-type: none"> <li>• Excellent electrical insulation properties</li> <li>• Resists chemicals, water, moisture permeation</li> <li>• Clarity ranges from translucent to opaque</li> </ul>	Flexible ice cube trays, tumblers, dishes, bleach and detergent bottles, rigid and squeeze bottles, pipe and fittings, silo covers, freezer wrap
Polyfluorocarbon (a thermoplastic)	<ul style="list-style-type: none"> <li>• High impact strength</li> <li>• Excellent stability over wide range of temperature</li> <li>• High corrosion and chemical resistance</li> </ul>	Cooking utensils, printing plates
Polyphenylene oxide (a thermoplastic)	<ul style="list-style-type: none"> <li>• Excellent electrical and mechanical properties, dimensional stability</li> <li>• High temperature resistance and hydrolytic stability</li> </ul>	Pipe valves, pump parts and fittings, electrical-electronic applications, sterilizable medical and dental instruments
Polypropylene (a thermoplastic)	<ul style="list-style-type: none"> <li>• High strength, stiffness</li> <li>• Resists chemicals, stress</li> <li>• Good heat resistance</li> <li>• Light in weight</li> </ul>	Packaging, luggage, furniture, housewares, oil pipe, wire coating
Polystyrene (a thermoplastic)	<ul style="list-style-type: none"> <li>• Rigid</li> <li>• Good optical qualities</li> <li>• Water resistant</li> </ul>	Toys, battery cases, instrument panels, wall tile, cigarette packs
Polysulfone (a thermoplastic)	<ul style="list-style-type: none"> <li>• Strong, rigid, ductile</li> <li>• Resists acid, alkali, oil, detergents, alcohol</li> <li>• Self-extinguishing</li> </ul>	Portable power tool housings, under-the-hood auto parts, electrical switch-housings, appliance parts
Polyurethane (a thermoplastic)	<ul style="list-style-type: none"> <li>• Elastic, strong</li> <li>• Resists abrasion, cuts, tears</li> <li>• Gasoline, solvents</li> <li>• Low air permeability</li> </ul>	Wire and cable jacketing, luggage coating, guide rollers, fuel containers, adhesives
Silicone (a thermoset)	<ul style="list-style-type: none"> <li>• High heat stability</li> <li>• Good electrical properties</li> <li>• Water repellent</li> <li>• Weather, acid and corrosive salt resistant</li> </ul>	Coil forms, switch parts, motor insulation, cabling, power cables
Urethane	<ul style="list-style-type: none"> <li>• Unusual wear and abrasive resistance</li> <li>• Excellent adhesive qualities</li> <li>• Resists chemicals, solvents, oil products, water, rot, vermin</li> </ul>	Most widely used plastic, employed in nearly every industry from clothing to railroad
Vinyls (a thermoplastic)	<ul style="list-style-type: none"> <li>• Rigid or flexible</li> <li>• Tough and strong</li> <li>• Water and abrasion resistant</li> </ul>	Paint additive, adhesives, flashbulb linings, pipe, tubing, flooring, exterior home siding, shower curtains, rainwear, phonograph records, shoe soles, upholstery fabric, screening

(Text continued from page 47)  
of Medical Sciences in Boston, Dr. Miguel Refojo has put together a family of plastic gels called poly-electrolite complexes that are soft, and permeable to fluids. What are they good for? Contact lenses, for one thing. Jelly-like, but optically sound, they will conform to eyeball shape, and allow fluid exchange between cornea and tears. No more rigid cups that irritate and must be removed to rest eyes.

At the Giannini Scientific Corp. in Tustin, Cal., engineers have come up with a method of applying thermoset plastic coatings to almost anything by plasma jet spray.

Things like epoxy, nylon, polyethylene can be sprayed on flat or outside curving surfaces by means of a water cooled powder injection tube operating at 3000° F.

Other major applications for plastic in the near future will show up in appliances. Tomorrow, your entire refrigerator and freezer probably will be made of plastic. The units will consist of a one-piece plastic cabinet with a full-length integral self-hinged plastic door. Sub-assemblies will be secured with epoxy (another plastic) to provide firm, vibration-free operation. Bare wires will be covered with plastic insulation and have plastic electrical connectors on each end.

Among the benefits the homeowner will derive from such units are near-silent operation, controls that will maintain a constant temperature, and a surface that won't stain, mark or scratch.

Other new straws-in-the-wind for the plastics in your life include the following:

- Solid plastic sinks, bathtubs and toilet bowls that won't chip or stain.

- Phenolic water valves and high pressure pipe fittings that resist corrosion, and have greater dimensional stability and impact strength than present material.

- Tough plastic coatings that will bond and reinforce concrete and masonry, extending their life by preventing crumbling and cracking.

- Reinforced plastic wire insulation that will never tear or crack, and will resist moisture and severe shock loads.

- Decorative, intricately detailed household ornaments made of non-destructive plastic but resembling glass, marble, wood, leather, fabric, ceramic, pettepoint and semi-precious stone.

- Musical instruments, from the simple violin bow to the cumbersome, wrap-around sousaphone and gigantic grand piano. Advantages over brass and wood versions are several. Plastic instruments are practically indestructible — they won't dent like brass or dry out and split, or swell up and warp. They are usually lower in price than their metal and wood counterparts, and they weigh less.

- As for your automobile, the upcoming applications are endless. Recently, Monsanto vice president, Robert K. Mueller, told the National Industrial Conference Board: "The recent move on the part of the gov-

ernment to force safety factors in the design of the automobile gives plastics an opportunity that could not be foreseen two years ago. The lamination of embossed vinyl to steel for some auto tops was so well accepted from an aesthetic standpoint it may move on to the hood and fenders—not as an aesthetic measure, necessarily, but to cut down on spectacular glare—one of the safety factors the government is advancing.”

A less spectacular but probably a more entertaining application for plastic is its use in making sports equipment of all sorts. The archery bow, right, is made of fiber-glas, a use which speaks well for the material's strength and exceptional flexibility.

Cleaning the head mates, may soon be a slick job when the new Head-Mate marine toilet (bottom) is installed. Wilcox-Crittenden's supercompact toilet is made of Bakelite corrosion-resistant, rigid vinyl and vitreous china. Union Carbide Corp.

If Mueller's prediction comes true, you may soon be buying cars with simulated leather-(or other texture)-coated fenders, hoods, decklids, quarter panels, etc.

That's not all. One reason for the reticence of American car buyers to accept all-plastic bodies, has been the fact that they like shiny cars. It is more difficult to provide plastic with a high gloss finish than it is sheet metal.

However, if the government does



This marina (partitioned area for docking boats) is constructed of polyester plastic reinforced with glass fibers. Developed by Glas-Dock, Inc., the material is a boon to shipowners. It needs little maintenance, and resists moisture, weather and erosion.



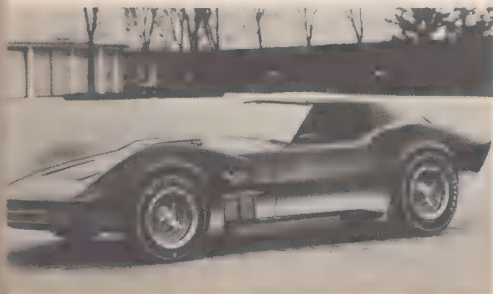
require manufacturers to use plastic or plastic-coated metal for body parts, a recent development may achieve both objectives of glare reduction *and* shininess. The development is called Raypan by its developer, Raypan Development, Inc.

The material is composed of a combination of glass fibers with a core of urethane in a matrix of polyester resin. According to Allied Chemical Corp., which supplies the plastic material for Raypan, auto bodies can be produced which have a finish equal to metal. Cited as an example is the all-Raypan Mako Shark II, an experimental design for the Chevrolet Corvette.

- Other developments under way for cars include seamless high density gas tanks of polyethylene which are less prone to explode on impact; the entire back surface of rear-view mirrors is bonded to vinyl to keep glass fragments from flying should the mirror shatter.

To describe all the "gee whiz" applications of all the burgeoning plas-

A plastic car, the Mako Shark II, Chevy's experimental design for Corvette, has a body made of Raypan, which is designed to take a finish as shiny as metal.



tics would take a shelf of books. You need a dictionary just to learn the names of the staggering varieties of plastic compounds—acrylonitrile-butadiene-styrene, polypropylene, polyfluorocarbon, polyphenylene oxide and the like. Future developments requiring different names will be even more confusing.

To help straighten out the multiple terms and types of plastic, and their applications, refer to the chart on pages 48 and 49. This chart provides a quick and handy guide to these materials. There are, though, certain factors to keep in mind regarding plastics as a whole.

The term plastic, like the term metal, is at best a generic name. It is an inadequate description of a man-made material, because each type of plastic has its own characteristics, density and molecular weight. There is no one type that combines all advantages or meets every requirement. Each offers some specific advantage such as optical density, good insulation, high impact strength, dielectric strength, and moisture- and weather-resistance.

However, each type of plastic can be placed into either the thermoplastic or thermoset family. The thermoplastics are those which soften when exposed to sufficient heat, and harden again when cooled. This process repeats itself no matter how frequently the material is exposed to heat and cold. The thermosets are those plastics that are permanently set by heat and pressure during fabrication.

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## Significance of these new developments to industry, business and professions

● *Agriculture*—Polymers will replace concrete, stone and asphalt in field irrigation networks. They will line the sides and bottom of catchment basins, reducing the cost of water to the farmer—from \$10-\$25 per 1000 gallons to \$1-\$2 per 1000 gallons. Farm ditches will be lined with plastic to prevent growth of weeds and provide more uniform irrigation. Plastic pipe will be used to divert water from irrigation canals to furrows.

● *Automotive*—Today's car carries over 35 pounds of plastic parts. By 1970 this is expected to increase to 100 pounds, replacing heavier materials in every area from engine to body components. "Auto-Body-Ject" machines will mold a body in color, in one piece, in one shot—entirely of plastic. Squeaky loosened welded or bolted joints and body cancer will be ancient history.

● *Boating*—Polyester plastic reinforced with glass fibers will soon replace steel, wood, aluminum and concrete in the construction of marina docks, providing minimum maintenance; no need for painting; resistance to sun, salt water, oil, gas, marine worms and growth; ease of installation; lightweight; and low initial cost.

● *Construction* (Residential and commercial building)—You name it, it will be walls, roofs, paneling, paints, coatings, insulation, wires, cables pipes and fittings, tile. As Dr. C. A. Barr, vicepresident of Union

Carbide says, "new polymers will fill specialized needs. They will successfully compete with metals, rubber, paper and ceramics."

● *Electronic*—Plastic materials will provide even better electrical qualities than those now available. They are being developed for potting, lamination and printed circuitry. Precision capacitors will be made smaller and more reliable because of the thinness and heat resistance of such materials as parylene dielectrics. As true conformal coatings become available for the first time, they will enable coatings of uniform thickness over complex surfaces without sag in valleys or thinning on sharp points. New developments in semiconductive plastic will permit production of conductivity more readily than by present use of graphite filler.

● *Graphic Arts*—Development of new polymer species, especially in phenoxy and polysulfone, will provide more economical printing plates that are easier to handle and lighter in weight. Parylene coated condenser bundles will aid in desalination of salt water. Highly sensitive temperature probes for ocean research will be protected by thin plastic cases to permit rapid, sure response.

● *Optics*—Paper-thin, exceptionally strong optical instruments will be developed from plastic. For example, presently available parylene pellicles are already being used as beam splinters in instruments.

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## NEW FOR INDUSTRY

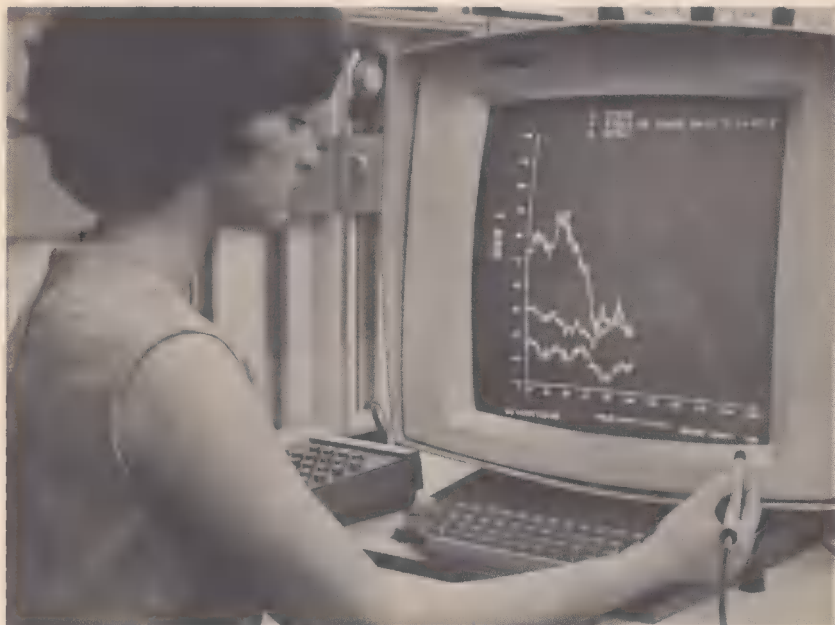


New protective clothing is designed to protect government and industrial rescue workers so they can operate near or in radiant heat up to 1,600 degrees F. The suits are made up of several layers of new Fiberglas Beta fabric and are non-combustible. They are known as "proximity suits." The manufacturer is Fyrepel Products, Newark, Ohio.

New FM transmitter, size of a stack of 24 quarters, broadcasts strain gauge readings to a nearby receiver. The world's smallest set, it's made by Wallace-Murray Corp.

Full color TV images from black and white slides are possible with this unique new projector, which reads color information in the film. Maker is ABTO, Inc., N.Y., N.Y.





Instant graphs are now being "drawn" on TV-type screens by computer, eliminating the painstaking manual plotting of points and lines. System was demonstrated on an IBM experimental prototype. Operator fed in data via light pen and keyboards; seconds later graphs of three stock closing prices for five-month period appeared on screen.

High energy liquid laser, only six inches long and about as thick as a pencil, can produce a power pulse equivalent to that generated simultaneously by 10,000 hundred-watt light bulbs. More economical than solid-state lasers, it has applications in medicine, exploration, drilling, welding, meteorology. Device is made by GT&E Labs.



# Test yourself on mental health

by Flora Rheta Schreiber  
and Melvin Herman

**T**HIS month, the spotlight is on you, the reader—on what you, as reflected in a survey, think about mental illness; on what you regard as acceptable or sick behavior.

The fragile line between the normal and the abnormal, the healthy and the sick, the acceptable and the unacceptable, emerges from the prism of public scrutiny in a survey made by a team of Columbia University investigators headed by Jack Elinson, Ph.D., Chief Research Scientist, New York City Community Mental Health Board, and Dr. Marvin Perkins, a psychiatrist who is the Commissioner of Mental Services for New York City. The findings are based on the responses of 3,000 New Yorkers from all five boroughs and from every income, educational and occupational level, whose ages range from 20 to over 70 and who are of both sexes. A book published by the Mental Health Materials Center of New York will emerge.

The study clearly shows that mental health, once relegated to hushed tones and frightened glances, to shame and guilt, is now regarded by

the public as an illness like any other. One out of every two adults questioned has known someone who has had professional help for mental and emotional problems. Almost as many, moreover, admit to having had personal problems for which they themselves could have used such help. No longer the strange phenomenon it once was, mental illness is now regarded as treatable. Significantly, in both these views the New York public closely parallels the point of view of psychiatrists and other mental health workers themselves.

## Laymen more knowledgeable

Significantly, too, the public, as reflected in this sampling of 3,000, is often sophisticated enough in things psychiatric to be able to differentiate sharply between behavior that is properly classified as illness and cultural behavioral distinctions. The questions were presented in the form of brief vignettes which we have reproduced. You may see yourself, your relatives, or a friend,

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Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

in these brief stories. Give your own answer. Then turn to page 58 to see whether you agree or disagree with the public interviewed.

We also asked the investigators about these questions. Jack Elinson, Ph.D., is a sociologist, Elena Padilla, Ph.D., is an anthropologist and Marvin Perkins, M.D., is a psychiatrist. Their views of the illness or lack of illness and the reason the stories were selected are given. We believe you will also find it interesting—and perhaps beneficial—to see how near you come in your thinking to what the scientists think.

*After reading each vignette below, write at the end of it whether in your opinion the subject, by his (her) action, exhibited signs of emotional illness or not—plus your interpretation of what the actions do indicate.*

1) A man who is known as a good husband begins to curse his wife one night. He hits her and threatens to kill her. He says she is working against him just like everyone else.

2) A young woman of average appearance keeps to herself. She just stays home and daydreams most of the time. She shows no interest in her parents, or a job, or young men or anything else.

3) A family man, successful in his job, is always moody and touchy. He loses a lot of sleep worrying about things that might go wrong.

4) A family man never seems to be able to hold a job very long because he drinks so much. Whenever he has money in his pocket, he goes

on a spree. When he sobers up, he comes home, begs his wife to forgive him and promises to stop drinking. But he always goes off again.

5) A retired man moves in with his daughter and her family. They always had known him as a good father and grandfather. Now they all find that he butts into everything and is cranky and hard to live with.

6) A married couple is having trouble. The husband is the kind of man who has for many years held a very low paying job. His wife thinks their marital trouble is his fault since he is not able to provide economic security for his family.

7) A laborer stops at a bar for a few drinks on his way home from work. When he gets home, he always fights and argues bitterly with his wife in front of their children.

8) A married man, father of two handsome children, who enjoys his work and his family, likes to wear clothes made for women. When he comes home at night and on weekends, he wears his wife's clothing around the house.

9) A handsome young man is always getting into fist fights. He has lost some jobs over them and has often gotten into trouble. But he still looks for these fights, because he believes they are necessary to show he is a real man.

10) A stockbroker has several cocktails at home every evening. He always engages in long and bitter fights and arguments with his wife in front of their children.

## Results of public survey (Experts' analyses follow)

### 1) Man Hits Wife

72.2% of the public surveyed said there is a clear sign of illness.

• • •

*The investigators said:* We are all aware of difficulties in marital relationships. The difference between just angry behavior and ill behavior is one of degree. The threat to kill may be real. Remember, the man always has been a good husband. This means he wasn't accustomed to beating his wife. The old story, "I know my husband doesn't love me anymore because he's stopped beating me" doesn't apply. If this action is a break with the past, it is a serious sign. But the clue to illness is in the final sentence: She is in league with everyone else against him. This indicates depths of disturbance.

This vignette was written from a clinical description of a paranoid. This one and several others are modifications of stories tested in scientific surveys previously.

### 2 Woman Keeps to Self.

64.5% of the public surveyed said there is a clear sign of illness.

• • •

*The investigators said:* This is a tough one to see. Fewer than 64% would recognize this woman's actions as a sign of illness in themselves or their families. It is difficult to accept one's own behavior or that of one's family as illness. Ex-

cuses are found. Quiet behavior is overlooked and denied as illness. Something much more flamboyant must flare up before notice is taken.

### 3) Successful Man Moody

Only 22.4% of the public said there is a clear sign of illness.

• • •

*The investigators said:* The man is seen as a product of what W. H. Auden has called "the age of anxiety." As part of this age, we are ready to accept anxiety as the chief problem of our time; the worriers as our symbol. Margaret Mead reminds us, that "the right amount of anxiety is necessary to make society work." The investigators point out that the man in this vignette, however, has gone beyond just being moody and touchy. He has actually become unstable. Only 32% called him disturbed because we see him all around us. His behavior goes beyond the irritability we expect from ourselves and from others occasionally. He may have a deep-seated emotional problem.

### 4) Spree Drinker

68% of the public said there is a clear sign of illness.

• • •

*The investigators said:* "Why did 32% say no? We suspect because they drew a distinction between misbehavior and illness. They made a moral judgment instead of a diag-

nosis. The spree drunk is seen by the public as ill while the steady, drinker is less apt to be."

### 5) Cranky Grandfather

87% of the public said he was not ill.

• • •

*What the investigators said:* The vignette showed the difficulties between the generations. A man who has made his own way economically and has enjoyed emotional independence cannot accept dependency. It is natural for him not only to feel inadequate and angry, but also to react strongly to the change in his circumstances. We see it all the time. It's a matter of the degree of change in the man that counts.

There is an interesting background to the inclusion of this story. It was suggested by a study on psychiatric insurance in which it was reported that quite a large number of families were trying to get psychiatric help for men in this situation. The insurance problem is: Does a company pay for psychiatric or social problems or only for psychiatric illness? The investigators wanted to learn if the public generally saw the man in the vignette as ill and if they would seek psychiatric help for him.

### 6) Marriage in Trouble

8.2% of the public said there is a clear sign of illness.

• • •

*The investigators said:* The marital trouble may be new and may well be a sign of maladjustment.

However, they said it is important to note that neither the inability to earn a living that satisfies one's wife or her discontent that her husband doesn't is a sign of illness. The key, however, is in the second sentence: *He's the kind of man who has for many years held a low paying job.*

If he is avoiding opportunities and performing below his potential, then, of course, some kind of help may be essential. Since the vignette fails to present views that might characterize this man as a non-conformist, all we have to judge by is the scanty testimony of the wife that low finances are the root of the marital problem. It is therefore possible that the essential conflict, though reinforced by the economic, may really have to do with not seeing eye to eye on this and perhaps other issues.

There also is an interesting story behind the inclusion of this vignette. In a well-known study which was published as *Americans View Their Mental Health*, it was reported that women said the number one reason they were unhappy was that their husbands didn't earn enough money. Here the investigators were testing this response. How closely did the public relate this question to mental health? Of those who responded that help was needed, 36% suggested a counsellor, only 3% a psychiatrist.

### 7) Laborer Drinks

29.8% of the public said there is a clear sign of illness.

• • •

*The investigators said:* There are

two kinds of heavy drinkers in our society; the high income level drinkers who are called alcoholic and ill and the drinking poor who are considered common drunks. In this regard, Dr. Morris E. Chafets, Director of the Alcohol Clinic at Massachusetts General Hospital, said recently, "I have never seen an alcoholic. I have seen humans with every problem seen in psychiatry and the only thing they shared was an unhealthy preoccupation with alcohol."

#### 8) Man Wears Wife's Clothes

90.6% of the public said there is a clear sign of illness.

• • •

*The investigators said:* Since each of us has his private definition of illness, the assumption is that 10% regard behavior of this sort as something odious rather than as a mark of illness. They are saying, "I refuse to call the man ill but can only say that he has problems."

#### 9) Young Man Fights

52.6% of the public said there is a clear sign of illness.

• • •

*The investigators said:* This vignette reflects a social norm. In New York, perhaps thankfully, people saw this pugnacious young man as being sick. In another society, say Puerto Rico (where the study is also being used) or in Mexico, he is more likely to be considered as proving his manhood. Behavior we are accustomed to, we accept as normal; behavior we don't see fre-

quently, we are less sure about. It may be illness.

As part of the study, the investigators plan to see how persons under 25 years of age responded as opposed to the rest of the sampling.

#### 10) Stockbroker Drinks

32.5% of the public said there is a clear sign of illness.

• • •

*The investigators said:* This is the third of the series on alcoholism. You can see the difference in responses to the spree drinker and the two steady drinkers. The responses to all three show that the two-thirds of the public is not yet ready to call heavy drinking an illness.

Each of these drinkers poses the same question. One, the spree drinker, sounds sick to the public. But the other two, one a poor man and the other a wealthy one, received the same vote of confidence. Other studies have shown that there is a class conscious approach to seeing someone as ill. The results in this study did not follow those lines. Both rich and poor were seen alike.

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Most of these vignettes are not clinical descriptions of mental illnesses. There is, therefore, no score against which you can measure your own decisions. The vignettes were selected to find out what the public thinks, not whether the public is right or wrong about mental illness. The comments show more about the society we live in than about the persons in the stories.

by Ed Parks

I ANSWERED the knock at the door to find a couple of youngsters carrying a box.

"My brother says you raise baby animals," the older boy blurted. "So can you raise these? Mom won't let us keep them."

"Let's see what you have," I answered, and I thought to myself, "Here we go again".

The box contained two very small bobcat kittens, eyes still closed, crying steadily, and barely able to squirm, like two fur-covered worms. My heart sank as I thought of the odds against their living.

"Where'd you get them?" I asked.

"My big brother found them out on the desert. Their mother had left them."

The usual story, I thought. Too bad more people don't realize that wild animals don't desert their



A baby Danish deer appropriately enough called Bambi, shares a snack from the oven with his dog friend. Food for wild pets demands a lot of time and attention.

## Is it wrong to make pets of wild animals?

young, and that the mother of those two bobcat kittens was probably just out hunting, or was frightened away by the approach of the boys.

After talking a while, I thanked the boys and they left. I'm very much against the taking of baby animals from their mothers, but the damage was done.

Soon I'd heated a small pan of milk, diluted with water, into which

I'd put a small amount of corn syrup. I sat on the floor, spread a towel on my lap, picked up the kittens, got an eyedropper full of warm milk, and began to feed them.

Every two or three hours, all through the night, my wife and I took turns feeding the kittens. By the next day they were taking milk quite readily, and I began to have faint hopes for their survival.



Potter the Fox shows Sooty the kitten the proper way to lap up the cup of morning milk, as if to say, "Drink it up, baby, if you want to grow up big and strong like me."

Those two kittens grew like weeds. The female was weaker than the male, and this general weakness resulted in her death when she was not quite a year old.

We still have the male, a fine healthy specimen of a bobcat . . . He's a year and a half old now, loving as any family dog, and is doing well on a diet of jackrabbit.

So of course when people ask about him, I tell them he's a really wonderful pet, but that I'd definitely not recommend their getting one. This apparent paradox brings lots of questions, usually beginning with,

"Why, do you think it will turn on you someday?"

No, this is not one of my fears, for I don't feel any animal will "turn" on its human benefactor. Certainly any wild animal, even those supposedly "tame" like our bobcat, may someday attack and seriously injure the very same persons it has learned to love. But I don't feel that the animal "turns."

First problem for the average animal lover is a simple legal one: It is illegal to keep wild animals in any kind of captivity without a permit. As an employee of a conservation agency, I can keep the creatures, but an ordinary citizen may not be able to get permission.

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Another stumbling block for most people is that there is some special training and understanding required to handle wild animals.

Once a person does take a wild creature into his home, I feel he is morally responsible for that animal as long as it lives. He has taken it from its natural habitat, therefore should feel obligated to care for that animal as long as it lives. If a person decided after a few months that he can no longer take the time to care for his pet, he can't just turn it loose. That animal has learned to depend on people, and wouldn't know how to get food for itself, nor how to hide or defend itself from enemies. Release into the wild is almost certain death.

One of the hardest things about getting any pet is the sure knowledge that you will one day lose him. This knowledge never hit harder than the day I got our pet coyote, "Yip." I got her from a Fish and Wildlife Service trapper, but only after I had signed a receipt which stated "for scientific and display purposes, to be destroyed and not transferred to any other person or agency when finished with it."

I rationalized, as I signed, that I would never be "finished with it," but would keep her until she died of some natural cause. Yip grew rapidly into our lives and our hearts, becoming an actual part of the family.

Then one day when Yip was nearly a year old, the axe fell. I was moving to another state, and learned that under the terms of the receipt that I had signed, I could

not take her with me.

Ending with my own hand the life of that trusting pet was the most difficult thing I've ever had to do.

Other wild pets must sometimes be destroyed because of social pressures in a community, or because the animal becomes unmanageable for some reason.

Even the daily care of a wild animal is not easy. If illness strikes a person, you rush him to the doctor. But what if a pet badger gets sick? What do you do? Certainly there are veterinarians, but usually their knowledge is limited to the normal domestic animals. Few know how to care for the wild ones.

### **Feeding is often tough**

Feeding is another problem, for giving a wild animal a proper diet is difficult. Our bobcat is fed almost entirely on jackrabbits—but imagine the job of keeping a large male bobcat supplied with rabbits every day. Many nights are spent hunting rabbits. These are cut up, wrapped, and frozen for future use. If we lived in a state that wouldn't allow night hunting of rabbits, we'd be very hard pressed to furnish an adequate diet.

Wild pets can also restrict your activities. If your family decides to go on a week's vacation, you can leave your dog or housecat at a kennel and be sure they'll get good care. Imagine the same situation if you happen to have a couple of bobcats and porcupines.

Other aspects that many don't

consider, but which could cause trouble, are the legal points. Many states will not allow the keeping of some species of wildlife, and most require a permit of some type to hold anything. But let's say you get a permit, and decide to raise an orphan bobcat that somebody took from a den. All goes well until the neighbor child wants to pet the six-week-old kitty. The child gets scratched, though no worse than she's been scratched many times by her own housecat. Still, you are suddenly open to a lawsuit because you are keeping what most people consider to be a dangerous wild animal in your home.

There are also other problems that can come up unexpectedly. If your neighbor has a dog that barks in the night and awakens you, you probably don't do much about it unless it becomes a persistent annoyance. But just imagine your reaction if suddenly about 3:30 one night you are awakened by the piercing wail of a coyote howling within 15 or 20 feet of your open bedroom window.

Or, maybe your pet owl learns to fly down onto your shoulder to be fed when you stand in the yard and whistle. This is fine until that afternoon when a salesman, whistling happily, comes through your front gate. It's a great way to get rid of salesmen, but also a great way to get in trouble.

So all in all, there are many responsibilities and problems involved with the raising of a wild animal pet. You find that to do it properly

you must devote a good share of each day to that pet. To keep him tame you should be with him every day for awhile, the more the better. Just tossing him food each day isn't enough.

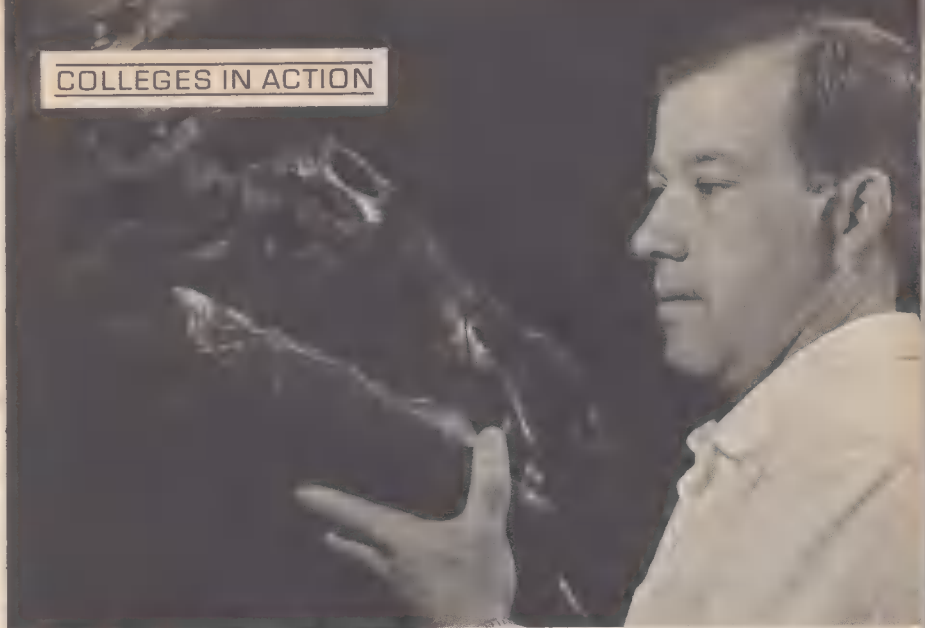
But for the few who are qualified, and who decide the trouble is worth it, there is much reward in raising a "wild" animal. You can learn a tremendous amount from them, not the least of which is respect for that species.

### **People learn respect**

Pets have also helped educate others to the value of certain species of wildlife. I know many persons who will not shoot a coyote, badger, bobcat, porcupine, or other species because they have had an opportunity to become acquainted with that species as somebody's pet. If I can help educate just one person, I feel all the trouble of raising that animal has been worth while.

Others I have known have used their wild animal pets in schools, on television, and elsewhere to help explain conservation to interested audiences. These people are dedicated to the teaching of conservation, and their interest is in the animal, and what they can do with that animal to help further the spread of conservation information.

So if you really have a sincere interest in the animal, can qualify for the necessary permits, and are aware of the many, many problems involved with raising one, then you might be able to do a good job of it.



No, it isn't the dried-out skull of a cow dead of thirst. This *Camptosaurus* skull, from a dinosaur millions of years old, is being examined by James Madsen, University of Utah paleontologist. It is one of many skulls from the university's prehistoric "bone barn."

## "Old bones" store sells out

THE "bone barn," as it was referred to by students at *Utah U.* ever since it opened in 1960, is all "boned out." The university's world-famous dinosaur department store closed up not only because it was running out of allosauruses—its hottest item—but also because it is starting "phase two" of its antique reptile project.

The old dinosaur bones, which come from a fantastic dinosaur graveyard in east central Utah, were

in great demand by museums throughout the world. For the past seven years, the university has been digging them up and making them available in "kit" form—a sort of "assemble your own dinny" arrangement. The knocked-down dinosaurs were numbered and shipped complete with a blueprint for easy rebuilding. More than 30 such kits were placed in various museums all over the world at fire sale prices. The *Allosaurus*, a hideous flesh-eat-

ing monster that bounded around the earth on two powerful hind legs, tearing other monsters to shreds with its teeth, was most in demand.

Dr. William L. Stokes, professor of geology and dinosaur project director, has now begun an in-depth study of Utah's own bulky collection, and also of the graveyard itself. Recently, diggers have turned up many specimens that appear to be new to science. Dr. Stokes and his colleagues also hope to solve the mystery of why there is such a massive concentration of so many different types of dinosaur in the quarry. The deposit is three to five feet

thick and lies directly beneath the surface of the 50-by-100-foot dig. Parts of 70 different dinosaur types have been discovered so far. The investigators will search for clues as to why entire dinosaur populations were wiped out.

The Utah dinosaur project is the only one of its kind in the world. Scientists involved in it point out that, if fan mail and public interest is any indication, it may well revive a new era of dinosaur popularity the likes of which the world hasn't known since Hollywood released a black-and-white silent film of *The Lost World* back in the 1920's.

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## 40,000-year-old Americans

Well defined projectile points, hide scrapers and other leather-working stone tools, dug from deep layers of an ancient 100-foot thick geological deposit near Puebla, in Central Mexico, may prove that man has been in the new world more than 40,000 years.

The startling find, uncovered by a research team from *Harvard's Peabody Museum*, under Prof. J. O. Brew, was associated with the remains of animals, including mammoths, mastodons, and long-extinct varieties of camels and horses. Distinctive volcanic ash overlying three of the sites where the tools were found, were dated by the carbon-14 method. One test yielded a date of 19,600 years; the other, 40,000. The archeologists—Cynthia Irwin-Williams of Harvard, and Juan

Comacho of the *U. of Puebla*, believe the older date is correct. Up until now, the generally accepted date for the appearance of man in this hemisphere has been 12-15,000 years ago. Further volcanic ash correlations are being made by the U.S. Geological Survey and by Virginia Steen-MacIntyre of the *U. of Idaho*, to resolve the discrepancy in the Carbon-14 dates.

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## "Bird brain" research

Don't call a dope a bird brain; the birds may take offense.

That's the word from Dr. Laurence Stettner, assistant professor of psychology at *Wayne State U.*

Under a National Science Foundation grant, Dr. Stettner is exploring what goes on in birds' heads. "Since they have a small cortex, it has been assumed that birds have little learning ability," he says. "but

now it seems likely that a bird's learning ability depends not on the cortex, as in man, but on the corpus striatum and the hyperstratum—a unique part which, in some forms, may well rival man's brain in capacity."

So watch it.

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## Big guns to fire wind

A super-wind tunnel capable of blasting air at Reynolds numbers 10 times higher than ever achieved in a facility of its type, is one of the unique features of *New York U's* spectacular new aerospace lab. Engineering the high-powered air-blaster took some fancy engineering ingenuity—including the novel idea of using huge, six-inch naval gun barrels for the air which builds to 30,000 psi and temperatures of 2000° F.

Designed to simulate speeds up to Mach 20, the big tunnel will be used to develop technology for a revolutionary 17,000 mph "space plane" that will fly at altitudes up to 200,000 feet.

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## Liverwort lady's bonanza

Recently two *U. of Cincinnati* students and their leader, Dr. Margaret Fulford, spent weeks crawling on their hands and knees through dripping masses of wet vegetation in Puerto Rico's mountainous rain forest looking for liverworts. The tiny moss-like plants, genus *Hepatica* are important to Dr. Fulford, professor



Long view of two of the three six-inch naval gun barrels which have been modified to contain air at 30,000 pound pressures for new wind tunnel at NYU's Aerospace Laboratory New York.

of botany at Cincinnati, since she is the world's top authority on them. She has hunted them down in such unlikely places as Lapland, Patagonia and Trinidad (to name a few). She even traveled 1000 miles down the Amazon in pursuit of odd varieties of the unique herb—which *might* be a moss if it didn't have the wrong reproductive cycle and gametophyte structure.

The hunters didn't expect to find many in the dank Puerto Rican jungles that are alternately deluged, baked and socked in by fog.

But they came home with 750 packets of liverworts—enough for years of work in classification and structure determination.

## A SCIENCE MYSTERY



Literally clouded in mystery, Peru's lost city of the Incas, Machu Picchu, was discovered in 1911. Stonework, sacrificial chambers and private bathrooms can still be seen.

K.F.S.

# The lost city of the Incas

*Overhanging a 3,000-foot precipice on a saddle between twin 10,000-foot peaks, the remnants of a strange Inca City, its origins and history, are likely to remain forever hidden in mists that swirl about the towering Andes.*

by L. Sprague de Camp

ON the morning of July 24, 1911, three men emerged from a trail on the banks of the Urubamba River in Peru.

The three men were a guide, a

Peruvian soldier, and a young professor from Yale named Hiram Bingham. Nervously they inched their way across a flimsy bridge of poles lashed together with vines, which spanned the gaps between the boulders. These boulders protruded

from rapids, where the Urubamba roared past on its long journey to join the mighty Amazon. Safely across the chasm, they attacked the steep slope. Sweating, slipping, creeping on all fours, and scaling tree trunks placed against the slope, they climbed up and up, until they reached a long flight of ancient terraces. Above these they found themselves in a maze of ruined houses made of ponderous granite blocks.

Half hidden by brush, the ruin stood in a saddle between two enormous peaks, both rising over 9,000 feet above sea level: Huayna Picchu to the north and the even higher Machu Picchu (10,300 feet) to the south. Four thousand feet below, the Urubamba, looking like a mere brook, curled snakelike about the foot of Huayna Picchu. Outlying works occupied the slopes of the two peaks; some of these, on Machu Picchu, overhung a 3,000-foot vertical precipice.

This extraordinary citadel had no known name. None of the Spanish chroniclers mentioned it. It was locally known as Machu Picchu, after the taller of the two peaks.

Next year, Bingham was back with a larger expedition, which cleared the site and explored the old Inca roads.

Bingham led further expeditions there in 1914 and 1915, before going on to a distinguished career in aviation, politics, and business up to his death in 1956. The fact that Machu Picchu was so long unknown, the appalling site on which it stood, and the silence of the chronicles

about it all wrapped it in mystery. Today, however, one can visit it much more easily than could Bingham sixty-odd years ago. One takes a train along the Urubamba Valley and transfers to a bus, which snakes up a terrifying switchback road to a tourist hotel amid the crags. From there it's but a short walk to the ruins. Still, much mystery remains.

The city of Machu Picchu—whatever its dwellers called it—straggles for 700 yards along the saddle between the two peaks. The southern end, towards the peak for which it has been named, consists of more than fifty agricultural terraces and a few stone buildings. A single, massive stone wall bounds the terraced area on the southeast.

The northern end of the settlement, separated from the southern by a long, straight ditch and a pair of walls athwart the saddle, consists of stone houses, with only a few terraces. The houses are divided into groups, as if they were meant for separate clans. Most of the lower walls are of massive cyclopean masonry, fitted and keyed with meticulous care, while the upper parts are made of smaller stones.

The houses were crowded together, but the many narrow streets and rock-hewn stairways made it easy to get about the town. Where possible, houses had little garden plots. Machu Picchu was furnished with over a hundred stairways, some having as many as 150 steps. In some cases, an entire flight of six to ten steps was laboriously pecked out from a single ledge or boulder.

Was Machu Picchu a fortress, a walled city in the usual sense? That depends upon what we mean by "wall." Machu Picchu had plenty of walls bounding agricultural terraces; but it possessed no single, continuous defensive wall encircling the entire structure. There is some fortification where the trail up the mountain enters the main gate. Otherwise it is hard to tell whether any of the massive stonework was meant as a defense rather than as a house or terrace wall. But then, a city surrounded by such hair-raising precipices hardly needed defensive walls of the usual kind. The terraces furnished platforms whence to drop rocks on attackers' heads.

### Enter the Incas

Bingham insisted to the end of his days that Machu Picchu was the "Tampu Tocco" of Fernando Montesinos, a seventeenth-century priest and historian. According to Father Montesinos, long before the Incas, a mighty dynasty called the Amautas ruled the Andean region. In the reign of the sixty-second Amauta, about A.D. 800, barbarian hordes overran the empire and slew the emperor in battle. Some of the Amauta's men took his body to a refuge called Tampu Tocco, buried it, and chose a new king.

The little kingdom flourished until population pressure made its rulers look abroad. About the twelfth or thirteenth century, King Manco Capac (Manku Ohapag) seized Cuzco, and founded the Inca Empire.

Bingham matched details of this

story with things he had seen in his Peruvian travels. These resemblances led him to identify Tampu Tocco with Machu Picchu. Thus, Montesinos said that Manco Capac built a wall with three windows at Tampu Tocco, and Bingham found such a wall at Machu Picchu.

Most modern students of Andean history, however, disagree. They do not think Montesinos trustworthy for ancient events. Nor do they admit that Manco Capac was real; more likely he was a culture hero—one of those mythical demigods whom many peoples have credited with founding their nation and discovering the useful arts. Or he represented, not a single real ruler, but a whole pre-Inca dynasty.

Even if he were real, the legends say he came to Cuzco from the south—perhaps from Tiahuanaco, another ruined city with a mysterious prehistoric past. But Tiahuanaco lies several hundred miles southeast of Cuzco, while Machu Picchu is northwest of Cuzco, in the opposite direction.

If Bingham was wrong, the likeliest explanation of Machu Picchu is this: The Incas did not fortify whole cities. Instead, near each city, they built a hilltop fortress—like those of Troy and Zimbabwe in the Old World—which they called a *pucará* and to which the citizens could flee. The immense fortress of Sacsahuamán, surrounded by sixty-foot walls made of stones weighing up to 200 tons, was the *pucará* for the Inca capital of Cuzco. And Machu Picchu could have been a

*The Incan Empire was a benevolent despotism. Every peasant family, clan and tribe had its own lands to farm.*

pucara for villages on the Urubamba. Some think it was built in the early fifteenth century, against the raids of the Chunchos from the Amazonian jungles to the east.

This prosaic solution does not, however, clear up all the enigmas of the Andes, for it leaves unsolved the far greater mystery of the vanished Tiahuanaco Empire, which preceded the Inca hegemony.

In 1532, Francisco Pizarro, by seizing the person of the Inca Atahualpa in the midst of his tens of thousands of well-trained warriors at Cajamarca, gained control of an empire that compared in wealth, power, population, and territory with that of the early Pharaohs. Within a year, the Spaniards completed the astounding conquest of Tahuantinsuyu, as the Incas called their empire. During the following decades, a number of Spaniards—priests, soldiers, and Garcilaso de la Vega who was half Inca himself—wrote down such historical traditions of the Inca Empire as they could gather. Since the Andean nations had no writing, historians had to depend upon oral traditions; but these were fairly voluminous.

According to these traditions, the dynasty started with the probably mythical Manco Capac in the twelfth or thirteenth century. Other Incas followed, becoming more historical until Inca Viracocha, who reigned 1347-1400, is a fully his-

torical figure. Under Viracocha, the realm began its expansion, which continued until it embraced all of Peru, much of Ecuador and Bolivia, and the northern half of Chile.

The original Incas were a leading clan of the Quechua (or Keshwa) tribe. This clan ruled the tribe, and the tribe ruled the empire. The head of the clan, who became the emperor, was called Sapa Inca, "the only Inca;" but all his fellow clansmen were Incas, too. As the empire grew, the Sapa Inca found that he did not have enough kinsmen to occupy all the posts in the empire, so he promoted promising men to be honorary Incas.

The Inca Empire may have been the world's most successful benevolent despotism. Every peasant family, clan and tribe had lands assigned to it. The assignments were revised from time to time to make sure each family could support itself. Along with their own plots, the Andeans had to farm those of the church and the state. Church lands supported the priesthood of the state religion. This was sun worship; but, in addition, the gods of the conquered peoples were welcomed into the pantheon.

The state lands supported, not only the Inca and his officials and soldiers, but also aged and crippled subjects and those who had lost their own crops through misfortune. Since the empire had no money,

taxes were in the form of labor. Every year, each able-bodied man had to put in so many days at such labor, constructing roads, public buildings, and so forth. Men in their fifties were given only light work or retired on pensions.

Still, Inca rule had its drawbacks. Even if he never starved, the ordinary Andean peasant dwelt (as many still do) in frightful squalor. He lived a very restricted life, unable to move, to change his occupation, or to travel on the excellent roads without special leave. He was so severely regimented that, when the Spaniards overthrew the Incas, he obeyed his new masters as meekly as he had the old. At least, he obeyed them until the oppression of the Spaniards—who exploited the peasants more harshly than the godkings ever had—drove him to frantic but futile revolts.

Under the Incas, the Andean Indians reached a level of civilization much like that of the Egyptians of the first two or three dynasties. As far as anyone knows for sure, they did this on their own, without influence from the Old World.

The most striking of the pre-Inca cultures was that of Tiahuanaco, whose remains lie at the southeast end of the 12,644-foot-high Lake Titicaca, the highest navigable lake in the world. To judge from the spread of its artistic styles, Tiahuanaco was once the center of an empire comparable to that of the Incas. The ruins, scattered over a sixth of a square mile, include truncated

pyramids or artificial hills, a terraced pyramid fifty feet high, rows of monoliths, platforms and underground chambers.

There are also monolithic gateways, in which the two upright supports and the lintel are carved out of one solid piece of stone. The largest of these, the "Gateway of the Sun," was chiseled from a single block of hard andesite. It is ten feet high, 12.5 feet wide, and weighs nearly ten tons.

What little we know about Tiahuanaco is the following: An earlier, simpler culture, Tiahuanaco I, appeared before the Christian Era. A later, imperial Tiahuanaco II arose between A.D. 500 and 1000, spread its rule far and wide, and fell before the Incas rose. When the Incas conquered the bleak *altiplano* around Lake Titicaca, they found Tiahuanaco deserted; at least, that is what they said. The people of the region were the Aymaras, a dour, silent folk who still grow potatoes and herd llamas in the thin air of the frosty plateau with its glaring suns and frigid nights.

Legends contain a few hints of the Tiahuanaco Empire, but nothing whence we could reconstruct its history. Since the Tiahuanacans had no writing, there is no way to restore the lost story of Tiahuanaco. Without it, both the history of the Inca stronghold at Machu Picchu and the enigma of the Tiahuanaco Empire are likely to remain forever hidden in the mists that swirl about the towering peaks of the Andes.



## How to stay healthy and happy while traveling

by Joseph D. Wassersug, M.D.

WHETHER you're planning 18 cities and twelve countries in twenty-one days, two weeks in a cabin on a lake in Maine, or a trailer trip with your family up the Alcan Highway to Alaska, your vacation junket can be safe and pleasant or filled with discomfort or tragedy. The difference sometimes is in the advance planning. It's good to know, *in advance*, what health tips are necessary.

Suppose you plan to go by plane. Unless you have a very bad heart or lungs, the cabin pressure in most jets is high enough to keep you fairly comfortable. Remember that even severely wounded battle casualties can be transported safely by plane.

But what if you are subject to motion sickness, claustrophobia, vague anxieties? A simple sedative or tranquilizer taken upon leaving home or before boarding the plane is often all that is necessary. Motion sickness tablets are readily available, even without a prescription, and can be taken to suppress any queasiness. A seat in the middle of the plane affords a smoother flight than at either end. Night flights are usually less annoying than travel during the day because it is easier to snooze away your time.

Blocked eardrums due to pressure changes can be avoided by having a nasal spray handy in your pocket which can be used before ascent and descent. The spray must

always be used twice—the second time, four or five minutes after the first. On a long flight inhale the spray every three or four hours. The spray opens the eustachian tubes, balances the pressure on either side of the eardrums, prevents earaches or annoying deafness. Yawning repeatedly, swallowing, or moving the lower jaw from side to side also helps.

### **Keep shoes on**

A few other hints about prolonged air travel are in order. It's best *not* to take off your shoes because your ankles might get swollen (from prolonged sitting) and then you will have difficulty in getting your shoes on again when the plane lands. A light sweater is handy for overnight wear. Wiggle your toes, try to get your legs up, walk around a bit.

If you travel by automobile and have squabbling children in the back seat of your car, feed them a motion sickness tablet or two. It may quiet them down and make the trip more enjoyable for everyone. Most motion sickness tablets act as mild sedatives.

In most good American hotels and local vacation spots you can almost always be sure that the food is wholesome and the water pure. You need take only those precautions that you would take at home. Be careful of creamed chicken, creamed tuna, eclairs—things that spoil if left out of the refrigerator too long, especially on hot days.

Avoid pork in any but the best restaurants. It may not be well cooked, and there's still danger of trichinosis.

Food and water supplies in Europe are ordinarily safe, nowadays, but it's best to have had your typhoid shots before departure. Recent epidemics of typhoid in such highly "civilized" countries as Switzerland and Scotland remind us from time to time that disease can strike anywhere. With international travel being as extensive as it is, a smallpox vaccination is a must. The travelers you meet somewhere en route may have been in contact with smallpox. Besides, without a certificate of smallpox vaccination or re-vaccination, you can't get back into the United States. A person who has not had a vaccination in three years must be re-vaccinated.

### **Turn away from tap**

In most areas of Europe, and in the mid-East, it's safer to drink bottled water, bottled beverages or wine, than ordinary tap water. In some places cautionary warnings are posted advising you not to drink the water from the faucets, nor to use tap water for brushing teeth. But warning or no, it's a good idea not to drink tap water overseas—especially in the Far East. One exception is Japan, where the water is as safe as that in your own home.

When camping out, especially in Central and South America, chlorine antiseptic tablets must be used or water must be boiled to make it

*"Museum feet" can be avoided if you wear comfortable shoes, rest often and treat foot problems before your trip.*

safe. A patient of mine drank some water from a crystal clear mountain stream in Guatemala and almost succumbed to a dysentery infection. Green uncooked vegetables may be as dangerous as, or more dangerous than, the water supply if the green vegetables are grown in the local soil. Another patient was "brave" and ate an attractive lettuce and tomato salad at the Hongkong Hilton and got a personal lesson in the need for obeying the rules. But since he had had typhoid and cholera shots, his distress did not last too long and he returned home safely.

If you plan to do a lot of walking, as you must if you visit shrines, temples, museums take along shoes that you have already worn and know are comfortable. Podiatrists recommend that you take three pairs of shoes; one pair of heavy-soled shoes, one pair of rubber-soled shoes (for inclement weather), and one pair of shoes for evening wear. Some Band-Aids and corn plasters should be taken along just in case. Special foot problems should be treated *before* you leave, especially if you are going to do a lot of walking or mountain climbing. Good sneakers with arch supports are a must if your vacation includes summer sports.

If you travel by automobile, it is best to break up the trip by stopping every 100 or 200 miles. Get

out of the car. Walk around. Adjust the driver's seat to different positions. Prolonged sitting encourages swollen ankles, joint stiffness and even phlebitis. Exercise by walking may prevent trouble before it starts. It also prevents driver fatigue and hypnosis of the road.

Periodic "breaks" in the driving routine may slow you down a bit but may prevent costlier delays in distant hospitals. Furthermore, make sure that the muffler and exhaust systems are O.K. Keep a window open. Carbon monoxide is odorless and deadly. Even when carbon monoxide doesn't kill, it can cause annoying headaches and irritability. Stop a while. Walk around. Change drivers if possible. It's no fun if you don't get to your destination safely.

As for food, it's best to stay away from quaint, out of the way restaurants and street vendors of foods. This should not be a hard and fast rule. Part of the fun of travel is to try exotic local dishes, prepared in the local manner. In most cases one can eat the dietary staples of a country with impunity. If you're doing your own cooking, fruit and vegetables purchased at local stands should be carefully washed. In restaurants, avoid all uncooked dishes.

Wherever you go it is good to pack a "survival kit." Before you put it all into the suitcase where you can't get at it, get a small

(Advertisement)

# Doomed By Your Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply by remembering accurately everything they see, hear, or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this publication with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their self-training method in a new book, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Memory Studies, 835 Diversey Parkway, Dept. 690-018, Chicago, Ill. 60614. A postcard will do.

plastic bag and put some aspirin into it, Dramamine, antacid tablets (your diet and beverages in travel may be different from those at home), nasal spray, sleeping tablets (if you are not driving), toothbrush, toothpaste, cosmetics, and shaving equipment.

Now, what should you put into the "survival kit" that gets packed into the luggage? Most of the items mentioned above, of course, can be duplicated in larger quantities. But you should also take something for constipation and diarrhea.

## Intestinal pick-ups

If you are going by plane, or space is limited, tiny Dulcolax tablets are good laxatives and are preferable to bulky mineral oil or milk of magnesia. For diarrhea, there are many tablets containing combinations of sedatives and belladonna alkaloids, e.g., Belladonal, Butibel, Donnatal. One, called Lomotil, is especially good and has no sedatives. These do not take up any room and are usually more effective than the bulkier pectin mixtures. Your doctor can give you a prescription for these medicines if you have no medical contraindications to them such as *glaucoma*.

It is always wise to pack a few Band-Aids, some sterile dressing, an antiseptic solution, one or two elastic bandages. A tin of talcum powder with a shaker top is most handy and, if you have athlete's foot, a fungicidal powder or ointment. If you have any special medical prob-

*A survival kit should be part of traveler's gear:  
Include bandages, antiseptics and prescription medicines.*

lems, such as diabetes, migraine or heart disease, be sure that you take enough of your medicines to last you through the trip, plus an extra margin for an emergency extension.

Be sure, too, that you have all the shots you need. Besides tetanus, and smallpox vaccination, other shots will depend on where you are going. Ask your own doctor whether you will need typhoid, paratyphoid, typhus, yellow-fever or cholera injections. Plan well in advance so that you can have top immunity during your trip. Since you may get some severe reactions to some of these injections it's best to leave time before departure to get over the bad spell.

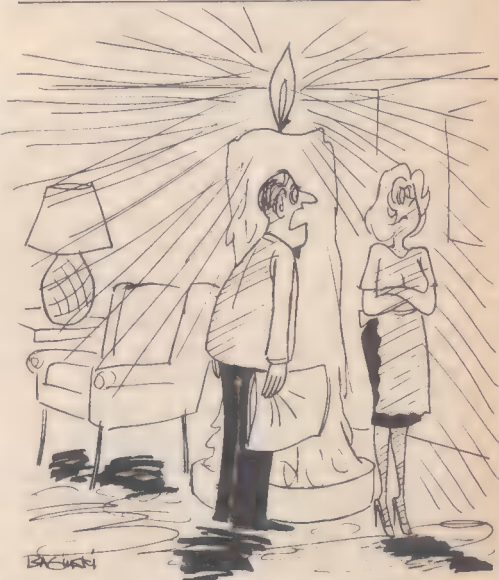
What else might you need? Some antihistamine tablets. They are versatile and can be used for the sniffles or for some itches and rashes. Some antihistamines also have a sedative action and are valuable as mild tranquilizers or sleeping pills.

What about antibiotics? Unless your doctor prescribes them for you for some special medical problem I do not believe they should be taken on a self-treatment basis. If you are sick enough on your vacation to need antibiotics, you need a doctor. Should you need medical care, how do you go about getting it? If you are in a hotel, the concierge or desk clerk can be helpful. On a traveling trip the guide will probably know where medical care can be found.

In the States, it's best to go to the nearest hospital for whatever first-aid measures are necessary.

One more word of advice. Be sure you know what poison ivy, poison oak and sumac look like before you find out the hard way. Learn the distinguishing marks of poisonous reptiles if you are going to places inhabited by snakes and scorpions. Carry anti-venin with you if you're going to be tramping through snake territory.

Now that the suitcases are all packed it's time to get started. So long, have fun, and keep well.



"... and I say my passive resistance measures are being felt by the electric company!!!"

## INVENTIONS

### Idea of the month

# Baggage bike

FOR the tired salesman with his samples and the traveler with his extra shirts, a woman inventor has devised a luggage scooter. Instead of carrying or dragging his suitcase, the owner is to ride it across terminal waiting rooms and along city streets.



Drawing for bike patent application

Patent 3,316,993 was recently granted for the motorized case, the *Science Digest* invention of the month, to Dorothea M. Weitzner of New York. At this writing it is not in production, but Miss Weitzner is trying to interest manufacturers.

The patent specifications cover a case with side panels for clothing and samples and a central section containing the engine and fuel tank. Besides handlebars for steering, the

drawings show license plates and headlamps.

The favored motor power is a gasoline engine, but suggested alternatives are compressed air and battery operation, and even overhead wires for a trolley.

If the owner does not want to set up his engine and get astride the case, he can tow it along on casters.

The luggage scooter is only one of Miss Weitzner's patented devices. The Inventor of the Month is a woman of independent income who has done considerable traveling. She decided in 1963 to devote most of her time to inventing, and has worked on a score of consumer products.

### Inventors' show

The 1965 International Inventions and New Products Exhibition, held at the New York Coliseum, gave her an award of merit for hollow plastic heels that serve as holders for overshoes. Another footwear invention is a combined shoe and roller skate.

Among the fields Miss Weitzner has explored are acoustics, printing, education, recreation, and household and hairdressing devices. She now holds a dozen United States patents and several granted abroad.

—Stacy V. Jones

## Metal-mesh "hose"

No nose is bad news. A natural nose warms and wets air on the way to your throat. Victims of throat cancer and many injured breathe through an opening cut in the throat. This dries the lining of the respiratory passages, thickens secretions and may cause infection. Air Force physicians found that wounded suffered especially from the dry air in high-flying planes when being transported home across the Pacific, so put together an artificial nose of metal mesh in a plastic tube. The mesh condenses moisture in exhaled air and adds it to inhaled air.

---

## Suits stops shocks

A special suit to protect people at 765,000 volts would seem useless. Who is nuts enough to need it? The men who repair super high voltage long distance power lines. They connect themselves to the power line so they will be at the same voltage and not get shocks. When they hook up there is a small surge of current which the suit is designed to conduct instead of the men's bodies. Carbon threads carry the current; glass threads give it strength. From Union Carbide.

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## 18 lb. Mini-scooter

Detroit notwithstanding, next to the foot, the ultimate in personal transportation is El Scooter. It is

18 pounds of zoom blasting off with one-half snorting horsepower. Top speed matches a sprinter. Designed by students at Illinois Institute of Technology, it looks like a tot's scooter. To stop, the driver, well uh, he drags his foot.

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## Speech repeater

You can listen to a speech in half the time it was delivered with a speech compressor from Infotronic Systems, Inc. Or you can reverse the process and make the speech last twice as long. Within limits you can adjust a talk to any length. The voice is neither higher nor lower than the original and is just as easy to understand. The trick is a rotating playback head on a tape recorder. If the tape speed is raised to shorten a speech, the head turns in the direction the tape is moving. If the tape is slowed, the head turns against tape movement. A far-out use might be to compress human speech for communicating with dolphins who seem to talk faster than man.

---

## Mechanical reader

A machine to read to the blind has been put in rough form by MIT engineers. It scans printed material, and converts it to phonetic symbols which are read off by a synthetic voice. Bugs are in the voice, which fails to put emphasis in the right places. At first, cost will restrict the readers to libraries.

## We're smarter about health

**W**E'RE increasing our knowledge of health matters—but not very fast.

The Kilander health-knowledge test, first used 30 years ago, recently was given to a group of adults in all walks of life and to college and high school students.

Dr. H. Frederick Kilander, special assistant to the president of Wagner College, New York, finds results showing a “slow but steady increase in the level of health information held by the public.”

Where the mean score for college students was 63 in 1936, it is 75 today. Girls and women tend to score slightly better than their male counterparts except in the area of human reproduction.

Following are some of the changes in levels of information:

- Only 1 in 10 today believes a child is disfigured if the mother is frightened during pregnancy (as compared to 1 in 3 in 1936).

- One in 6 believes incorrectly that tuberculosis may be inherited (only a slight improvement over 1936).

- Nearly half of high school students and 1 in 6 of college students and adults still believe incorrectly there is some truth in “fish being a brain food.” (No change from 1936).

- One in 5 individuals believe, incorrectly, as did the same ratio in 1936 that a “taste” for alcohol is

an inherited one.

- Ninety per cent said “early diagnosis” is the best way to reduce the death rate from cancer. (Big improvement over the 55 per cent reported in 1936).

- A prospective mother can make her child more musical if she listens to good music is believed entirely or in part by 1 in 3 persons. Exactly half of a group of 50 PTA mothers were similarly misinformed. (Same response as in 1936).

- Cooking of food decreases the value of certain vitamins is correctly reported today by 85 per cent of the public (as compared with 50 per cent in 1936).

- That a fever can be “killed” by drinking whiskey is correctly believed by 1 in 3 individuals. (A poorer showing than in 1936).

- That vitamin D is the nutrient preventing rickets is known by 2 in 3 individuals (a poorer score than shown in 1936).

- Three out of 4 know that sugar is used for energy rather than for building body tissue or regulating the body processes. (A slight improvement).

---

### Foam nose

The ancient Chinese fashioned a prosthesis made of wax to replace the loss of a nose. Tycho Brahe, the 16th century Danish astrono-

mer, who lost his nose in a duel, fabricated for himself a nasal prosthesis of gold and silver alloy. Alphonse Louis, French soldier, became known as the "gunner with the Silver mask" after he used silver to replace nearly all of the left side of his jaw, shot away by a shell fragment.

In modern times, says Dr. Peter M. Margetis of the U.S. Army Medical Biomechanical Research Laboratory, prostheses are made of rubber latex, polymethylmethacrylate, vinyl resins and more recently, vulcanizing silicone rubber. All the materials were developed for commercial use before being adapted for the fabrication of jaw and face prostheses.

A new silicone foam filler has been developed at Walter Reed that more closely matches human skin than any known hitherto. It is very difficult to tell where the prosthesis ends and the real skin begins, Dr. Margetis says.

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### Think fat, be fat

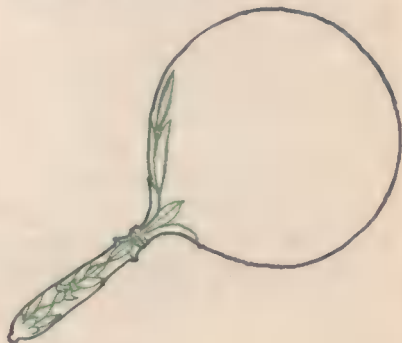
The fat ladies were seated before an image-distorting mirror, similar to trick mirrors at carnivals. As the experimenters adjusted the mirrors to reflect a variety of grotesque shapes, the women were asked to judge which image best matched their estimate of themselves.

Fat women do not think thin, experimenters found.

"The obese, on the average, judged themselves to be substantially broader than they are," said Dr.

William G. Shipman of Michael Reese Medical Center, Chicago.

This confirmed a clinical belief that obese persons often have strong feelings about their distorted physical size because of social pressure.



"They avoid mirrors and scales," Shipman says. "They do not recognize themselves in photographs. When slimmed down they often still 'think fat' when buying clothes or making a public appearance."

The subjects were 40 women who averaged 54 percent above normal weight. Between 20 and 45 years old, all were members of the TOPS club, a group that meets to give mutual support during dieting.

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### Brain-pressure relief

Pressure on the brain in babies with hydrocephalus can be relieved with a drug that acts like a chemical magnet, drawing the fluid into the bloodstream from where it is eliminated.

Dr. David B. Shurtleff, University of Washington pediatrician, said the

investigational drug, isosorbitol, has reduced intracranial pressure due to the excess fluid by an average of 50 percent.

If the value is confirmed with further tests, the drug might eliminate the current treatment for hydrocephalus which involves insertion of a tube into the cranial cavities to drain off fluid through the jugular vein. Called shunt surgery, the method has proven useful but has many adverse effects, including clogging of the tube and frequent tube changes to keep up with the growth of the child, according to the report in *Medical World News*.

### Answer to immortality?

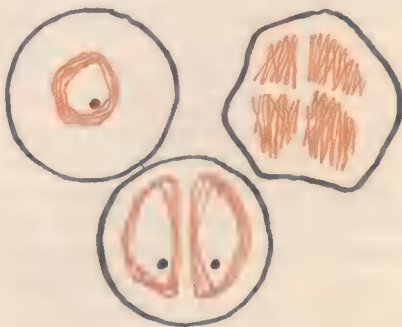
An answer to the mystery of man's inability to live potentially forever has emerged from cell research by a University of Pennsylvania scientist. The perplexing question arose in the 1920's when the French physician, Alexis Carrel, maintained chick cells in a growing state for 34 years by removing toxic accumulations. He finally threw the experiment down the drain with the conviction that if poisons could be removed from the human system, man would have the capacity to live forever.

Carrel's experiments were seized upon by authorities in geriatrics as proof that the aging problem is not due to events taking place within the cell but rather in bodily influences from the outside.

Dr. Leonard Hayflick of Phila-

delphia says it now seems certain that the opposite is true, that life and death of the cell, and thus the human being, is basically determined by intracellular events.

The fallacy in Carrel's work was



that he unwittingly added new chick cells each time he fed nutrients to the tissue culture. "Today we know that even with modern and sophisticated cell culture techniques, chick cells cannot be maintained beyond one year," says Hayflick. "Concepts of aging must be recast to include the probability that it is the result of functional failure at the level of the single cell."

The cell simply accumulates errors in its reproductive processes and its repair mechanisms are not always adequate to overcome them.

Dr. Hayflick compared it to automobiles: "We have come to expect that an inexpensive automobile has a mean time to failure of say, four years, and that an expensive automobile lasts perhaps 10 years. No one is surprised at the uniformity of the mean time of failure of complex machines.

In laboratory studies, Dr. Hayflick took tissue from human embryos in the third month of gestation, grew them in tissue culture and found the cells underwent about 50 generations of reproduction before dying.

When the process was interrupted at the 20th generation, for example, the cells stored at 250 degrees below zero, then thawed out and the cell division process renewed, the reproduction continued for only 30 more generations. The cells seemed to "remember" at what generation they were preserved. When placed again in a growing environment, they take off from that point until 50 are reached.

Oddly, the research showed that the only cells achieving immortality are cancer cells. They continue to multiply as long as there is food and only stop growing when they kill the organism, animal or plant.

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### Hormone-fixed memory

Ever wonder about the little woman's uncanny ability to remember every night you came home late, overlooked her birthday, picked up the wrong fork at a dinner party or spoke harshly to her mother?

It's her hormones.

A biologist says studies on animals show memory is enhanced by female sex hormones. Dr. W. R. Klemm of Texas A and M University says hormones tend to consolidate or "fix" an event so it will be remembered permanently.

The hypothesis is based on rat experiments. Ordinarily, a painful electric shock administered to the foot immediately after a learning experience will make a rat forget what it has just learned. But when female rats are in a period of high estrogen activity, they recall the learning experience in spite of the shock. The same applies if the ovaries are removed and the estrogens injected. With no such hormones, they forget quickly.

He also found that memory of an event becomes fixed in the permanent archives of the brain very quickly, probably within 10 seconds.

Apparently the hormones stimulate the building up of protein material in which the event is encoded for brain storage. This ties in with the molecular theory of permanent memory.

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### Organ farm

A San Francisco surgeon foresees the day when animals will be raised on farms—not only for food—but to supply vital organs for human transplants.

Dr. John S. Najarian of the University of California said research is centering on overcoming rejection by the human body to an organ transplant from a lower order of animal.

Dr. Najarian has performed 60 successful transplants of kidneys between human beings in the last three years. Around the world, there have been a total of about 1,200 kidney transplants since 1954.

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## FOR KNOW-IT-ALLS

Of course, you *don't* know it all, but you *want* to know it all. If there's one thing you hate, it's ignorance. Especially your ignorance.

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Above all, you *keep up*. And you know *what to keep up with*.

That means you seek out *new* information. You know the old ways of doing things, and you know there are better ways. You know that's what science is all about. You know science is finding out, knowing the truth about things—about people and the world they live in and the way they live. And you know science is discovering and pointing to the better ways at a rate that scientists themselves find staggering.

Is it too much to expect to keep up with it? It is for know-nothings. But for know-it-alls, here's a tip. **Take 18 seconds to fill out the above coupon and know it *almost* all for a year, or even two.**

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the Science Digest staff.



## Why we don't really know

### What is Heisenberg's Uncertainty Principle?

To explain the matter of uncertainty, let's begin by asking what certainty is? When you know something for sure, and exactly, about some object, you are certain about that piece of data, whatever it is.

And how do you get to know that something? One way or another you must interact with the object. You must weigh it to see how heavy it is, pound it to see how hard it is, or perhaps just look at it to see where it is. But there must be interaction, however gentle.

It can be argued that this interaction always introduces some change into the very property you are trying to determine. In other words, learning something changes that something through the very act of learning about it, so that you haven't quite learned it exactly after all.

For instance, suppose you want

to measure the temperature of hot bath-water? You put in a thermometer and measure it. But the thermometer is cold and its presence in the water cools it down just a bit. You can still get a good approximation of the temperature, but not *exactly* to the trillionth of a degree. The thermometer has almost immeasurably changed the temperature it was measuring.

Again, suppose you want to measure the air-pressure in a tire. You use a little plunger that is pushed out by a tiny bit of escaping air. But the fact that air escapes means that the air-pressure has been lowered just a tiny bit by the act of measuring it.

Is it possible to invent measuring devices so tiny and sensitive and indirect as not to introduce any change at all in the property being measured.

A German physicist, Werner Heisenberg, decided in 1927 that it

was not. A measuring device can only be so tiny. It could be as small as a subatomic particle, but no smaller. It had to make use of as little as one quantum of energy, but no less. A single particle and a single quantum of energy are enough to introduce certain changes. If you simply look at something in order to see it, you do so by virtue of light photons bouncing off the object, and that introduces a change.

Such changes are extremely tiny and we can and do ignore them in ordinary life—but the changes are still there. And what if you are dealing with extremely tiny objects where even extremely tiny changes loom large.

If you wanted to tell the position of an electron, for instance, you'd have to bounce a light quantum off it, or, more likely, a gamma ray photon, in order to "see it." And that bouncing photon would knock it away.

Heisenberg succeeded in demonstrating, in particular, that it is impossible to devise any method for *exactly* determining both the position and momentum of any object simultaneously. The more closely you determine the position, the less closely you can determine the momentum, and vice versa. He worked out just how large the inexactness or "uncertainty" of these properties would have to be and this is his "principle of uncertainty."

The principle implies a certain "graininess" to the Universe. If you try to enlarge a newspaper picture too far, you get to the point where

you see the little grains or dots and you lose all detail. The same is true if you look too closely at the Universe.

Some people are disappointed at this and feel it to be a confession of eternal ignorance. Not at all. We are interested in learning how the Universe works, and the principle of uncertainty is a key factor in that working. The "graininess" is there, that's all. Heisenberg has showed it to us, and physicists are grateful.

—Isaac Asimov

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### **How is sea level determined? Is sea level the same for all oceans?**

Rise and fall of tides and waves must be taken into consideration before sea level can be determined.

Scientists use a tide gauge for this—a float in a vertical tube that has perforations below the low tide level. All water comes and goes through these holes. This damps the effect of passing waves on the float. A wire from the float passes over a wheel that turns back and forth as the float rises and falls. The wheel movement drives a pen that traces a line on a revolving drum driven by clockwork.

The U.S. Coast and Geodetic Survey requires records of at least 19 years from many stations for an accurate determination of mean sea level. There are more than 40 stations along the coasts of the United States where such primary determinations have been made.

By carrying surveys hundreds of miles inland, mean sea levels for

different areas have been compared. These surveys have shown that sea level is not the same everywhere. The east coast of Florida, for instance, has the lowest mean sea level in the U.S. Along the cities of the gulf, it is eight to ten inches higher. Scientists believe that the primary factors accounting for variation in sea level are barometric pressure and water temperature. The lower the atmospheric pressure, the higher the sea level—and heated water tends to expand.

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### What are the principles of a laser?

The word *laser* is an acronym in which the letters stand for "Light Amplification by Stimulated Emission of Radiation." Like any radiation, a laser beam gets its energy from individual atoms, and actually makes use of a sort of chain reaction in producing its burst.

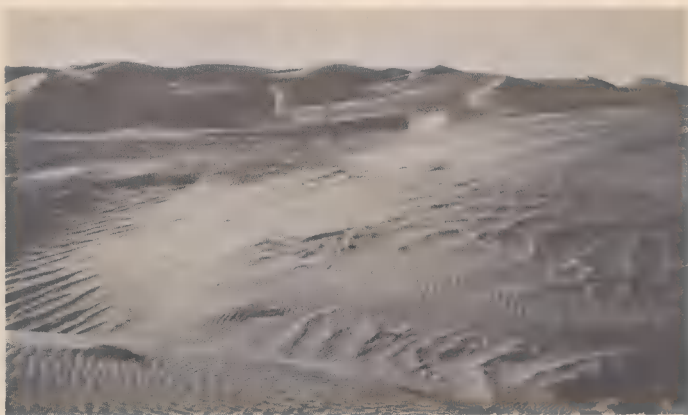
Unlike fission, however, a laser does not *split* atoms to release their energy; consequently, the same atoms can be used repeatedly to create the photons of light that make a laser "lase."

Like radio and TV, light rays are part of the electromagnetic spectrum and travel in waves of their own frequency and length. Usually, light rays scatter. Even the focused beam of a flashlight spreads and dissipates. And here lies the big difference with laser light. It fires a beam of controlled (coherent) light that is modulated. In effect,

the laser device lines up the photons so that they radiate in step.

Here's how it works in a ruby laser: When a light is introduced to the ruby crystal by the photo-flash "trigger," the electrons orbiting the nuclei of the ruby's chromium atoms are kicked into a higher orbit for, perhaps, a millionth of a second, then drop back to their normal paths. As they fall back, excess energy is released in the form of photons of light.

At this stage, the photons are as incoherent as any normal light. But those that happen to be traveling horizontal paths are captured within the crystal and set to marching in step by a simple trick. The ruby rod is mirrored at each end—the rear end more heavily than the front. These mirrors bounce the photons back and forth between them in a rapidly accelerating "chain reaction" or "cascade" of light, since the bouncing photons continue to trigger more and more energy from the chromium atoms as they move back and forth through the crystal. Hence, more and more photons are added to the horizontally traveling ray within the crystal. Once the photons reach a certain energy level (amplified billions of times), they burst through the weaker mirrored surface at the front end of the crystal in a pencil-like beam of coherent light—all of the photons traveling together in the same direction, at the same wavelength. All of this takes place in a fraction of a second and the laser beam is on its way.



## Ups and downs of climate

by John and Molly Daugherty

**T**HE Dolly Sods, a plateau about ten miles long on a mountain top in West Virginia, is unique in Eastern United States. It resembles the arctic tundra with its carpets of coarse moss, rare flowers and strange stone formations. It is only one of the world's climatic oddities. What do you know about others?

1. World maps of the climates of the earth show some unmarked blank spaces because
  - a. These regions have no climate
  - b. No data is available
  - c. The climate varies sharply
2. The diurnal (day and night) change in temperature is greatest in climate that is
  - a. Rainy tropic
  - b. Monsoon tropic
  - c. Arid tropic
3. Tropical rain forest vegetation, found only in tropical climates, is known as
  - a. Savanna
  - b. Selva
  - c. Tundra
4. The average monthly range of temperatures for the year is smallest in
  - a. Dublin, 52.2° N. Lat.
  - b. Montreal, 45.3° N. Lat.
  - c. Moscow, 55.5° N. Lat.
5. Bogotá, Colombia, and Knoxville, Tennessee, are alike in
  - a. Climate
  - b. Elevation
  - c. Average annual temperature
6. The climates of places with similar latitudes may differ. The heaviest precipitation of the following cities is at
  - a. Shanghai, China
  - b. Athens, Greece
  - c. Monterey, California
7. The Atacama desert along the west coast of northern Chile and Peru is one of the driest in the world although it is next to the Pacific Ocean. The basic cause of this dry climate is
  - a. High elevation
  - b. Poor soil
  - c. Cold ocean currents

8. In the temperate marine climate of Northwest America from Oregon and Washington northward to southern Alaska, greater weather changes occur when you travel from the coast

- a. 50-150 miles eastward
- b. 600-800 miles northward
- c. 25-50 miles westward

9. In the Northern Hemisphere the record for the greatest range of average temperatures from the coldest to the warmest months is held by

- a. Winnipeg, Canada
- b. Verkhoyansk, Siberia
- c. Dawson in the Yukon

10. The average annual rainfall varies from climate to climate. The rainy tropical has about 100 inches of rain, and the monsoon, around sixty. But there are exceptions where rainfall is excessive.

The rainiest of these places is

- a. Mount Waialeale, Hawaii
- b. Assam hills of East Pakistan
- c. Singapore

## Answers:

1—c The climate varies sharply. The blank spaces are mountainous regions or highlands like the Andes of South America. As you climb the mountains, especially near the equator, the climate changes rapidly from tropical to subtropical to temperate and so on to the limit of tree-growth and to the snow-line. Altitude is the principal climate control factor here.

2—c Arid tropic. Over a dry desert region like that of the Sahara, daytime temperatures may reach 135° F and at times, even 150° F. At night, because of the lack of cloud cover, radiation cooling takes place rapidly. The temperature may drop as low as 50° F. In the rainy tropics at the equator, the moisture-laden air and

cloud cover acts as a blanket so that little cooling occurs at night.

3—b Selva. The rain forest is usually a three-storey one, and much of the animal life is arboreal. The forest differs from forests in northern climates, which often have pure stands of one tree species. The rain forest may have as many as 150 species in one acre.

Savanna is an association of trees and grass that is often twenty feet tall. The tundra of arctic climates is treeless and sometimes covered with mosses and lichens.

4—a Dublin at 52° N. Lat. The average monthly range in temperatures from the coldest to the warmest months is only 19° F. Dublin has a temperate marine climate much like Seattle. Both Moscow and Montreal have a humid continental climate with a medium-length summer. At Moscow the range is 54° F; at Montreal, 56° F—even though its latitude is not so high. Air flow in these latitudes of the westerly winds is from west to east generally. When the air flow is over continental areas without the moderating effect of bodies of water, climate is more severe.

5—c Average annual temperature of 58.1° F. Although the averages are the same, the climates are quite different. Bogotá has a range of only 1.8° F between the averages of the coldest to the warmest months. In Knoxville the range is 38.1° F. Some people say Bogotá has a spring-like climate all the time because of its high altitude—8,660 feet, but it has none of the weather varieties you have in a mid-latitude spring, where you experience four distinct seasons.

**6—a** Shanghai, China. It receives about fifty inches of rain a year. The climate is humid subtropical like that of Charleston, S.C. Humid subtropical climates are found in the southeastern parts of a continent; and Mediterranean, in the southwestern margins.

Both Athens and Monterey have about sixteen inches of rain, and the rain mostly falls in winter. Both cities have a Mediterranean climate.

**7—c** Cold ocean currents. The cold Peru *oceanic* current is off-shore, but the Peru *coastal* current along the coast is even colder. The latter is 50 to 100 miles wide. It is formed from upwelling deep water. As air from the south and southwest blows over water onto the shore, it cools. But the air above it is lighter, and the air over the desert is so stable that rain seldom falls. At times heavy mists occur, but the land, too, is warmer than the water—which helps prevent rain.

**8—a** Fifty—150 miles eastward. The temperate marine climate covers a rather narrow coastal margin. When you leave this region, you soon encounter the continental climates. The

marine climate is the most moderate climate on earth for its latitude. You may travel 600 to 800 miles north along the coast with little or no change in climate. Coastal Norway has this marine climate with an ice-free coast in winter. A few miles inland, however, the continental climate is severe in winter.

**9—b** Verkhoyansk, Siberia. The January average is  $-58.2^{\circ}\text{F}$ , and the July average is  $59.3^{\circ}\text{F}$ —a range of  $118.1^{\circ}\text{F}$ . Verkhoyansk has a record low of  $-90^{\circ}\text{F}$ . Oymyakon in Siberia once reported  $-95^{\circ}\text{F}$ . The range of temperatures at Winnipeg is  $70.3^{\circ}$  and at Dawson,  $82.4^{\circ}$ .

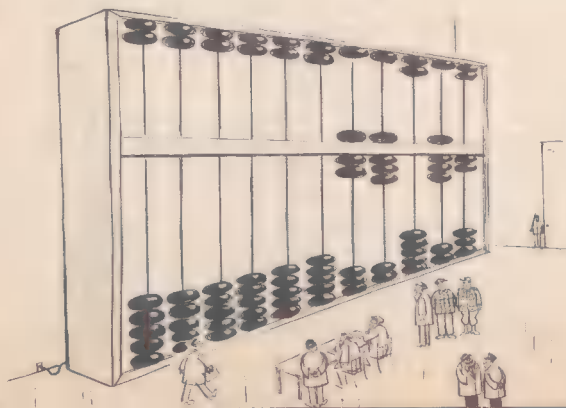
**10—a** Mount Waialeale, Hawaii, on the island Kauai. The annual rainfall is 471.6 inches. Parts of the Assam hills have over four hundred inches of rain. Singapore is average for its climate.

### Score yourself:

**9—10 right**—High altitude!

**4—8 right**—There's latitude in this range.

**0—3 right**—Don't stay in the doldrums.



"And you'll be working with some of the top computer men in China."



Charlie the Lion demonstrates an admirable stoicism while his two mischievous youngsters, Cass and Polly, playfully attack him, in one of 168 photos of charming lion family.

## Love in the lion house

*Pride's Progress, The Story of a Family of Lions, text and photos by Emmy Haas, Harper & Row (\$5.95)*

This remarkable collection of pictures (168 of them), and the author's delightful running commentary, are the result of several years of Haas' lion watching.

The book is a family record of a young pride of lions—Charlie and Princess and two sets of their offspring—on Lion Island in the New York Zoological Park's African Plains exhibit. It is, to our best knowledge, the first cohesive sequence of pictures of what goes on inside lion social circles. The book is filled with fascinating facts—many of them “firsts”—about lion behavior.

Great pictures prove beyond reasonable doubt that the tuft at the end of a lion's tail is made that way for the cubs to play with (see photo above). They also provide abundant evidence in support of the theory that “lion's are dogs in cat's

clothing,” for their family behavior is of close-knit, cordial familiarity. They are, as the author points out, highly social animals—a far cry from impersonal, cat-like independence.

In Emmy Haas's book, you'll see the characters in this story romping happily together. You'll discover that lions use their tails to caress each other. Princess drapes her tail across Charlie's back as they walk around together—sort of like holding hands. Both parents work with the cubs, training them in the ways of lions; are highly tolerant of the mauling they take from their energetic youngsters, but brook no nonsense. When her rambunctious male cub, Cass (for Casper; the female is Polly—for Pollux) got too frisky, Princess sat on him—literally. There's a picture of that, too. When the little ones got too close to the moat, both parents moved in to head them off, put a huge paw on them or cuffed them to safety.

There's little question that this remarkable volume will make more human friends for lions than they've ever had before. It will also make a lot more dedicated lion watchers at zoos everywhere.—RFD.

*Red Giants and White Dwarfs—The Evolution of Stars, Planets and Life; Robert Jastrow, Harper & Row (\$5.95).*

If you'd like to know how everything began, according to all the best theories to date, here is the book. It's written by one of our country's foremost astronomy experts—and he's done it in layman's English (If Marie Jastrow, his mother, couldn't understand something, he re-phrased it).

Robert Jastrow is director of the Goddard Institute for Space Studies, teaches geophysics at Columbia University and holds a Medal of Excellence from that institution. Throughout the book he exhibits a clarity of thought typical of the ranking physicist he is. But the best of this genuinely interesting book is its lack of scientific jargon, mathematics and Pentagoneses.

Dr. Jastrow starts with the nucleus and the atom to build an expanding universe in terms so graphically clear you can watch it grow through the immensity of the void (Big bang, steady state and the primordial fireball are covered, too). Stars are born and stars die, collapsing or exploding through the trillions of years. You live through the formation of our sun and its planets, the birth pains of our own

earth, the origins of life and the ascent of man.

*The Dolphin Smile, edited by Eleanor Devine and Martha Clarke, The Macmillan Co. (\$7.95)*

As the editors handily put it: "Here's every kind of Dolphin—sad and saucy, lonely and loving, staunch and studious. Dolphins who help fishermen, save sailors, poets and monkeys, mourn at a funeral, and run errands for the U.S. Navy. Dolphins to ride, dolphins to talk to."

That just about sums it up, for this is an anthology of dolphin legend, fact and poetry from, as they say, Homer to Hemingway. And if you grow weary of the redundancy of the ancients, just flip a few pages. You'll find something to intrigue you.

Early in the volume, the editors straighten out the confusion between dolphin and porpoise. They're dolphins!—despite a small fish of the same name. A porpoise, you will learn, is a particular kind of dolphin—without a bottle nose. It's nice to find some authentic accounts of New Zealand's two famous wild dolphins: Pelorus Jack and Opo. Jack haunted Pelorus Sound and met all the ships coming in across Cook Strait between North and South Islands at the turn of the century. But Opo, a lady dolphin played with the kids and let some ride her back.

Dr. Lilly and his dolphin research is here, too; so is Flipper and almost every dolphin you ever heard of.

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**PERPETUAL Motion Journal.** Sample copy 35¢. 1616J South Compton, St. Louis, Mo. 63104

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# LETTERS

TO  
SCIENCE DIGEST

## Sea Monster?

I was interested in the "sea monster" on your May 1967 cover. Having lived quite a few years near the water I have seen many sunken rowboats and I am quite sure that what appears to be the "head" of the sea monster is actually a boat.

EDGAR L. SPENGLER, JR.  
Charlton Heights, W. Va.

## The Yeti

The article on "Modern Monsters" (May '67) inspires me to comment on the references to the "abominable snowman" or yeti. No mention is made that the beast has been seen other than a statement by, "some natives and Western travelers."

A few years ago I read a book

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called "The Long Walk" It was the description of a Polish officer who was captured by the Russians in World War II, and transported to a slave labor camp. The author and six of his companions escaped from the compound, and the story of their trek for more than four thousand miles through Siberia, Outer Mongolia, the Gobi Desert and through the Himalaya mountains is told in the book. While climbing in the mountains the author and his surviving companions encountered two strange creatures, that fit no other description than that of the "abominable snowman" or yeti. I am inclined to believe that this is the only authentic case of the sight of such a strange animal, for certainly the author had no reason to fabricate the story.

CARL ALEXANDER  
Kosciusko, Miss.

*Exciting and authentic as this story may sound, it is another representative of the genre known as "travelers tales." Unfortunately, the authors did not document them scientifically. Without supporting evidence they cannot be regarded too seriously. As was stated in the article "The stories remain; possibly they mean a great deal, possibly not."—Daniel Cohen.*

I read "Modern Monsters, and found out many things about the yeti. I am very much interested in these things and if they are real or not I would like more stories like this printed.

RICHARD JENKINS  
Jefferson City, Mo.

### Running and walking

I enjoyed the article "Run for Your Life" (May '67). Running like walking is almost a lost art. In the past

few months I have started walking by necessity. I never learned to drive. Now I must walk to go shopping but I feel better and have lost 15 pounds.

ELMER J. BRASWELL, JR.  
Atlanta, Ga.

### The way it is

When one of America's best science writers can only say, "Because that's the way the Universe is," in defense and to explain a major portion of the king of sciences then it would seem there is a lot of room for error. In "Isaac Asimov Explains," May '67 this is just what he says regarding the speed of light.

JOHN W. ECKLIN  
Huntsville, Ala.

### Decrease not increase

I liked the Feb. '67 psychiatry column very much and enjoyed seeing how the symposium on mental depression was covered. However, there was one rather misleading error. In reporting the incidence of suicide at Harvard, the figure 25,090 students should have been 5,090 students; somewhere an extra 2 got slipped in. In other words, the suicide rate at Harvard decreased 50 percent instead of showing a marked increase as the article suggests.

DANA L. FARNSWORTH, M.D.  
Director Harvard University  
Health Services

*Dr. Farnsworth is correct; our correspondent—somewhere along the line in his research—picked up the wrong figure and, not realizing it was in error, drew a most convincing erroneous conclusion from it. We apologize to Harvard and to Dr. Farnsworth.—Ed.*

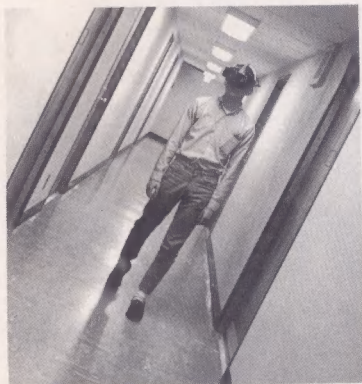


## People sniffer

**E**VEN your best friend won't tell you, but the Army's Man-pack Personnel Detector will. It is designed to pick up essence of human perspiration at distances up to 464 yards. The sensor is clamped to the underside of the soldier's rifle barrel and is connected to the electronic backpack by a flexible hose. If the 18 pounds of gadgetry senses key human effluent chemicals in the air currents, it sounds the alarm through an earphone strapped to the operator's head.

Scientists who developed the device first studied the way bedbugs catch a whiff of their human prey. The Army doesn't explain how a searcher tells the difference between the enemy and an unwashed buddy. A new slogan our fighting men might be wise to follow is: "A dainty soldier is a live soldier."

## In this issue . . .



If you wore the kind of goggles the man in this picture is wearing, you'd swear you were walking "swanwise" the way he appears to be walking. To find out why seeing is not always believing, turn to p. 14.



Hidden in the mists that swirl about the towering Andes, sit the spectacular remains of a fantastic city—Machu Picchu—whose origins and history remains cloaked in mystery. In "Lost City of the Incas" on page 68, author Sprague de Camp tells why it's still a mystery.



Pocket-size blankets of metallized plastic are windproof, waterproof and warmer than wool—and they unfold to standard dimensions for life-saving use. The item on page 27 in "New For People" describes them and their uses.

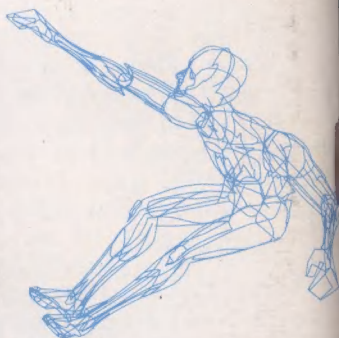


Whole cities on the ocean floor—and under it—are not just being talked about; they're being designed. From globe-like units like this to cavernous chambers in the earth's crust, you'll find them on page 36.

Anyone for an Allosaurus skeleton? Too late—they're all sold out, but more interesting things are now going on at Utah's "old bones" shop. If you're curious, find out what's new in dinosaurs on page 65.



Lumps of life known as manatees are being used as "lawnmowers" to trim the weeds from Florida's choked-up canals. The one above weighs half a ton—a top-drawer weed chomper. Details on page 33.



Now computers are drawing pictures of people. This sketch, a graphic representation of a sitting man reaching out, was programmed in London as part of a study in human factors. Item is on p. 31.